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TAXING CORPORATIONS ON PROFITS.

The latest development of the agitation against corporations finds its expression in the new tax scheme proposed by President Taft and up for discussion in Congress this week. We can hardly imagine such a scheme going through without a great deal of discussion; in fact, it is difficult to believe it can be carried at all if the proper opposition is lined up. As an alternative measure to an income tax, the plan to tax net corporate profits may have some constitutional merits, but it is certainly open to the fundamental objection that it aims a direct blow at the modern method of corporate operation, and discriminates against the corporation in favor of the business owned by an individual. This is indeed very significant and is a reversal of all the tendencies of the past hundred years, during which the entire aim of legislation has been to foster the creation and growth of corporations and to render it possible for a man with small capital to escape the limitation of enterprise thus inflicted by giving him the opportunity to associate his capital with that of others and also to become interested in large corporations as a part owner. All this is now to be changed, for while the profits of any and every stock enterprise are to be taxed, those of exactly the same business, if conducted as copartnerships or by individuals, are left free of this burden. It does not seem possible that discrimination of such a wholesale character can be constitutional; but if it is, the corporate principle has received one more serious blow.

It is particularly corporations of the public-utility character that are hit by imposts of this kind. Huge and small manufacturing and industrial enterprises are carried on without resort to the stock ownership principle; but the unincorporated public utilities, in the hands of one or two men, are extremely rare, and very few of them are large. It might be reasonably claimed that but for the operation of the corporate principle these utilities could not have come into existence, depending as they do upon the massing of large amounts of capital and the division of the risks. Now these utilities, in addition to all the heavy and special taxes laid upon them by the locality and the State, will have to submit to a further burden inflicted by the national Government. In a general way, a manufacturing concern can shift the burden of such a tax by adding it to the price of the goods, but a local company, bound by commissions, laws, ordinances and franchises, cannot change its rates for service or supply. There will, however, be the effort, more or less conscious, to check the actual incidence of such a tax on the net profits, and that means simply a serious temptation to skimp the service so as to maintain the dividend.

When it is considered that a sum of $25,000,000 is estimated as the yield of this tax, it would seem as though some better way could be found of securing that relatively small part of the $800,000,000 now collected by the Government. The tremendous

system of espionage necessary if the tax is to be honestly collected is one of the things to be deplored, equally with the attack on modern forms of investment and the check on habits of saving. Probably a million corporations will have this constant worry and a new artificial incentive to "dishonesty" akin to that fostered by the process of collecting customs from sea passengers at the wharves. But there are also many other points involved in determining net profits, in limiting conversion of stocks into bonds, of which the fixed charges must come off before the "net" can be reached. There is no need for us to enumerate here all the intricate questions that cluster thick around any such plan as this.

In 20 years the national taxation has risen from $6 to about $11 per capita. The population of the county has increased 45 per cent. The expenses of administering the affairs of the nation have jumped 170 per cent. It would seem that in the cure of this terrible disproportion might lie the full measure of relief. But if not, there are many forms of taxation better than this one with so many dubious aspects. For example, the stamp tax on checks and commercial paper is one of good yield from an infinite number of sources, yet is one of the easiest in the world to collect, and falls as righteously upon the rich individual as upon the struggling little corporation. We trust that those interested in public utilities will give this taxation scheme the consideration that many of them have not deigned to accord to the new tariff itself. Supine indifference and acquiescence can sometimes be carried a little too far.

Guarantee of Heating Devices.

The article elsewhere in this issue, by Mr. W. H. Wissing, of St. Louis, is a strong endorsement of the practice of the central-station company in that city of selling electric heating appliances with a guarantee by which the company assumes all responsibility of replacing defective devices. The prices charged are somewhat higher than usual rates—$6 for a 6-lb. iron, and other prices in proportion. With this, however, the company practically assumes the responsibility of maintaining these appliances in good condition indefinitely and without quibbling. It appears that irons have been sold at a considerably less price by St. Louis department stores, but without any guarantee. The policy of maintaining irons and heating appliances is somewhat akin to the policy of free lamp renewals so far as the central-station company is concerned. Both policies insure good service to the consumer. It is no advantage to a central-station company to have a lot of electric irons and other devices in its consumers' houses which are not in use on account of small defects, and which can only be repaired by an annoying experience with some local electrician. Many central-station companies have practically assumed the maintenance of electric irons and cords without so guaranteeing at the time of sale, as they have felt that to charge for repairs of this kind would be to discourage the business in its beginnings. Nearly all makes of irons have developed more or less trouble with cords and probably always will, as cords will wear out just as shoes or wearing apparel. Of course the time will come, and in fact has arrived in many towns, when the consumer would expect to pay something in the way of electric iron repairs for the use of the iron. It is to the interest of the central-station company, however, either to make these repairs itself at a minimum of expense and inconvenience to the consumer, or to follow the St. Louis practice of charging a sufficient price in the first place so that the iron can be maintained as long as it lasts.

Gas Engines in Small Central Stations.

The report of the National Electric Light Association committee on gas engines this year, as in previous years, dealt mainly with the larger sizes of gas engines, although the lists of actual installations included engines as low as 50 hp. The gas engine is really of much more immediate interest to small than to large central-station companies. In fact, the economies offered by the gas engine in small plants as compared with steam engines are likely to be relatively greater than in the case of large plants. The reason for this is that small gas engines show nearly as low a consumption of gas per kw-hour as the largest sizes. On the other hand, there is a great difference between the coal consumption per kw-hour in small steam plants and large ones. The relative economy of the gas engine compared with the steam engine in larger plants is, therefore, not so attractive to the large central-station company. The investment per kilowatt of capacity is much larger with gas engines than with steam engines, both in large and small plants. In the case of a small plant the gas engine and producer which give high economy of fuel come in competition with a steam engine and boiler costing much less per kilowatt of capacity, but usually giving very low economy of fuel. Until the small suction bituminous coal producer is more firmly established as a commercial success than at present, the competition will usually be between bituminous steam coal at a low price as compared with anthracite gas-producer coal at a considerably higher price. As the relative costs of these two kinds of fuel vary in different locations, the choice between a producer gas-engine plant and a steam plant for central-station service must be figured out in every case. At the present time, with the central-station load factors, which are common in well-developed central-station properties serving towns of 3500 and over and giving 24-hour service, the total cost of production per kw-hour, including interest on investment with both steam and gas plants, indicates that a considerably larger use of producers and gas engines will be justified in the future.

Children Should Be Instructed to Shun All Wires.

Not long ago this journal called attention in a news note to the number of accidents due to children touching or playing with electric wires in presumably inaccessible positions. It is gratifying to note, following this publication, that Mr. William Carroll, city electrician of Chicago, has sent a letter to the president of the Board of Education of that city directing attention to this important subject. Mr. Carroll thinks, and with good reason, that instruction on this subject should be given to the children of the public schools. There have been so many accidents caused to boys who come in contact with live electric wires by climbing poles on a "dare"; by picking up the loose ends of telephone wires that have come in contact with electric wires carrying dangerous potentials; by taking hold of broken electric-light wires; by throwing pieces of wire over trolley or other overhead wires to "see the sparks fly"; by using a piece of wire as a string with which to fly kites and

having the wire come in contact with live electric wires, or by similar causes—that the danger is shown by experience to be a very real one, which must be guarded against. Mr. Carroll contends that the children should be taught to avoid wires of all kinds as they would rattlesnakes. However harmless a wire may look, as Mr. Carroll says, there is a possibility that it may be connected in some manner with a high-potential circuit and consequently be dangerous to life.

This advice is timely and important. It is difficult to place wires carrying dangerous currents of electricity in such a remote position that the adventurous small boy will not climb up to them in a spirit of enterprise or mischief and receive possibly a fatal shock. The electrical company is not to be blamed when such an accident occurs, for usually it has done its best to make it impossible. The remedy seems to be educational in its nature. Children, and particularly boys, should be impressed with the fact by all parents and teachers that they must not touch wires any more than sample at random the contents of bottles in the medicine closet. Their foray may end in death in either case. Mr. Carroll has done wisely in calling this matter to the attention of the Board of Education of Chicago, and his example may well be followed in other cities.

ALTERNATOR ARMATURE WINDINGS.

In studying the voltage relations in the conductors composing an armature winding, it is convenient to hold continually in mind the fact that the electromotive force produced in each surface conductor on the armature is the same as that in each other surface conductor, while the electrical-time-degree relation of the individual electromotive forces is identical with the electrical-space-degree relation of the slots in which the conductors are placed. That is to say, when two slots are separated by 10 electrical-space degrees, the electromotive forces produced in the conductors occupying these slots are out of phase by 10 electrical-time degres. With thse facts in mind one can readily assign to the electromotive force of each conductor, or group of conductors, a definite value and time-phase position, and thereby determine the vector sum of the voltage obtained by interconnecting the various conductors to form a phase winding.

An article by Mr. Edgar Knowlton discussing in detail the method outlined above appears elsewhere in this issue. The author states that it is of value principally when the connections are unsymmetrical, and he proves its usefulness for analysis in this case. However, it is worthy of note that none of the advantageous features of the method is lacking when the connections are symmetrical; in fact, it possesses fundamental characteristics which render it useful under all conditions. In applying this method it is necessary to distinguish carefully between mechanical-space degrees and electrical-space degrees; for example, in a four-pole machine five mechanical-space degrees equal 10 electrical-space degrees. The fact that practically all machines are constructed with a certain definite integral number of slots per pair of poles allows one to assign a definite electrical-space position to each slot of a pole-pair, and the same position applies to a corresponding slot in each of the other pole-pairs. Any interconnection of the conductors which will give the proper value and relative time-phase position to the resultant electromotive forces in the armature is satisfactory from an operating point of view, but economy of constructive material and ease of assembly often dictate the selection of that interconnection which requires the least amount of material for the cross-connections and permits the use of symmetrical coils.

INTERFERENCE BETWEEN TELEPHONE AND ALTERNATING-CURRENT CIRCUITS.

All electrical workers are familiar with the disturbances that may be produced in a telephone circuit by the electric or magnetic inductive influence of neighboring alternating-current circuits. A loud hum is usually heard in the telephone, of a pitch corresponding to the frequency of the alternating current in the neighboring wire. The loudness of this hum may be so great as to make telephonic conversation impossible, while even a comparatively faint hum may give rise to inconvenience and distress in listening. An article by Herr Martin Höchstädter on this subject has recently appeared in the *Elektrotechnische Zeitschrift,* as referred to in the Digest. It deals with means for protecting the subscriber's station from such disturbances, or rather for reducing the effect of such disturbance to a minimum. The ordinary method of getting rid of such disturbance is by the transposition of wires. Either the telephone wires or the electric lighting wires, or both sets, may be transposed for this purpose; but the telephone wires are usually transposed, being the lighter and easier to manipulate. This method means overhauling the line, and may be troublesome to carry out. Moreover, there may be conditions under which transposition of the wires is insufficient to remove the disturbance. The article suggests two plans, or a combination of both, for reducing the disturbance, without any necessary change in the line wires.

The first plan is to insert a very small condenser in the receiving telephone circuit—say, a condenser of 0.05 microfarad. This condenser would naturally offer a relatively high condensance, or condenser-reactance, to the low fundamental frequency of the electric lighting circuit, and a much lower condensance to the vocal frequencies of telephonic operation. Consequently, the vocal alternating currents would be diminished to some extent by the condenser, but the induced low-frequency disturbances would be reduced much more. The second plan is to bridge the primary of an induction coil across the telephone circuit, and to connect the secondary to the receiver terminals through a suitable resistance in such a manner that the low-frequency induced disturbance current may not only be diverted across the telephone line through the primary, but that its inductive action in the secondary may be opposed in the telephone receiver to the residual direct action producing the hum therein. Of course, the voice currents will also leak across the telephone circuit through the induction-coil primary to some extent, but not nearly so much as the low-frequency disturbing current. By means of either, or both, of these methods conversational conditions may be restored to the telephone line. We are not here discussing the novelty of these methods, because that is a matter of considerable doubt, but the feasibility of such methods is of important interest to many electrical engineers who are bothered by noisy telephone circuits.

Twenty-Sixth Annual Convention of the American Institute of Electrical Engineers.

The Hotel Frontenac, Thousand Islands, New York, is the scene this week of the twenty-sixth annual convention of the American Institute of Electrical Engineers. Following its excellent custom the society has sought a place where there are many attractions but few distractions, and where a large attendance can therefore be counted on at all the sessions.

The number present is gratifyingly large, the registration up to Tuesday morning being no less than 250. A great many members reached the pretty island on Friday or Saturday and nearly four score had got their badges by Sunday. The recent hot weather made the coolness of the spot all the more appreciable.

The exercises were opened at 10 a. m. on Monday by President Ferguson, who delivered a brief but most interesting address on "The Centralization of Power Supply." Urging that this is a day of consolidation, he pointed out that the advantages in the electric-power industry from the manufacture in large quantities and with improved methods began to stand out boldly on the economical side; while the investor was favorably impressed with securities that were broad-based and required no detailed information. These securities were more easily marketed and on more favorable terms than had been the smaller issues of minor companies. The most important result was the economy effected by combined investment and output. The load factor of American central stations, i. e., the ratio of the average load to the maximum load, controlled absolutely the earning capacity of the investment. In modern large power systems the operating costs are now so low they represented a comparatively small part of the total costs. The fixed charges constituted by far the larger part; hence the importance of the load factor.

After discussing the conditions of the load factor, President Ferguson pointed out that the larger output of combined loads permitted the use of generating units with a high performance efficiency and requiring a small operating force, with the result of a further reduction of costs. He touched on the standardization of apparatus as the result of centralization, and on harmonization of frequency and voltage, and as an incidental gain to the community instanced the reaching of a higher public standard of cleanliness in every direction. He then noted typical examples of electricity supply, such as Newcastle, England, Niagara, California and Chicago. He spoke with great emphasis of the value of the diversity factor which "in most cases enables the supply company to underbid independent producers." In fact, it might be said: "The diversity factor is the very foundation rock of centralized energy supply. It is the birthright of the central station, the fundamental reason for its existence; and its resultant value belongs to the central station company."

Mr. Ferguson then spoke of the taking on of electric railway loads which were small as compared with the total requirements of any given metropolitan area, and said that by combining all systems of neighboring cities within a radius of 30 or 40 miles into a single centralized system, a great saving in production would result as well as a great improvement in service.

"The progressive work of the electrical engineer will determine whether we can reach out into these larger fields. . . . It is for the commercial electrical engineer—which really includes nearly all of us—to educate the layman and particularly the power user to an appreciation of the superiority and desirability of electric service, and to emphasize the material and ethical advantages to a community of centralized power production." It was also the duty of the technical electrical engineer to furnish the leadership and sinews of war in conquest of the fields where waste and useless dissipation of energy still prevail.

The reception on Monday evening was a very successful affair under the guidance of Mr. C. W. Stone, chairman of the committee in charge. Among those in the receiving line were President and Mrs. L. J. Ferguson, President-elect and Mrs. L. B. Stillwell, Vice-President Calvert Townley and mother and Vice-President J. G. White and Mrs. White.

A Proposed Tax on All Corporations.

An amendment to the Senate tariff bill was offered by Senator Aldrich last week carrying into effect the Taft plan of a tax on the net profits of all stock corporations. The measure comes up for debate this week. Practically every character of incorporated institution organized for profit is brought within the provisions of the corporation tax. The provision defining the concerns from which it will be collected is as follows:

"That every corporation, joint stock company, or association, organized for profit and having a capital stock represented by shares, and every insurance company, now or hereafter organized under the laws of the United States or of any State or Territory of the United States, or under the acts of Congress applicable to Alaska or the District of Columbia, or organized under the laws of any foreign country and engaged in business in any State or Territory of the United States or in Alaska or in the District of Columbia, shall be subject to pay annually a special excise tax with respect to the carrying on or doing business by such corporation, joint stock company, or association, or insurance company, equivalent to 2 percentum upon the entire net income, over and above $5,000, received by it from all sources during such year, exclusive of amounts received by it as dividends upon stock of other corporations, joint stock companies or associations, or insurance companies subject to the tax hereby imposed, or if organized under the laws of any foreign country, upon the amount of net income, over and above $5,000, received by it from business transacted and capital invested within the United States and its Territories, Alaska, and the District of Columbia during such year, exclusive of amounts so received by it as dividends upon stock of other corporations, joint stock companies or associations, or insurance companies, subject to the tax hereby imposed.

"Such net income shall be ascertained by deducting from the gross amount of the income of such corporation, joint stock company, or association, or insurance company from all sources:

"All the ordinary and necessary expenses actually paid within the year out of income in the maintenance and operation of its business and properties.

"All losses actually sustained within the year, and not compensated by insurance or otherwise, including a reasonable allowance for depreciation of property, if any, and in the case of insurance companies the sums required by law to be carried to premium reserve fund.

"Interest actually paid within the year on its bonded or other indebtedness not exceeding the paid-up capital stock of such corporation, joint stock company or association, or insurance company outstanding at the close of the year.

"All sums paid by it within the year for taxes imposed under the authority of the United States or of any State or Territory thereof.

"All amounts received by it within the year as dividends upon stock of other corporations, joint stock companies or associations, or insurance companies, subject to the tax hereby imposed."

Foreign corporations are also brought within the scope of the measure, so far as net profits in America are concerned. Every corporation liable to the tax is to make a sworn return through some official on or before March 1 as to all the essential items of its business, revealing capital and profits, and a false return carries with it a fine of $1,000 or a year in prison, or both. After returns have been made to the office of the Commissioner of Internal Revenue and assessments have been made, the returns become public records open to inspection.

Convention of Association of Iron and Steel Electrical Engineers.

The Association of Iron and Steel Electrical Engineers held its second annual convention in Buffalo June 23, 24 and 25. The program of papers previously printed in these columns was presented. Visits to the Niagara Falls power plants, Lackawanna Steel plant, and to other iron and steel industries of Buffalo and immediate vicinity were scheduled for the closing day, so that only a brief meeting was held on that day. Before closing the business session Pittsburgh was selected as the next meeting place.

Boston Section of the American Society of Mechanical Engineers.

The first regular meeting of the Boston section of the American Society of Mechanical Engineers was held at the Lowell Building, Massachusetts Institute of Technology, on June 11. Chairman I. N. Hollis presided, and the paper of Mr. G. A. Orrok on the "Small Steam Turbine," read before the recent Washington convention of the society, was discussed. Among the speakers were Prof. I. N. Hollis, Harvard University; Prof. E. T. Miller, of the Massachusetts Institute of Technology; Mr. C. B. Burleigh, General Electric Company, Boston; Dr. Lowenstein, General Electric Company, Lynn; Mr. R. H. Rice, General Electric Company, Lynn; Mr. C. B. Rennick, Ken Turbine Company; Chief Engineer London, of the Terry Steam Turbine Company; Mr. F. B. Dowst, of the B. F. Sturtevant Company, Hyde Park, Mass.; Mr. Holmes, of the De Laval Steam Turbine Company; Professor Reed, of the Worcester Polytechnic Institute; Mr. C. H. Bigelow, of Stone & Webster; Capt. C. H. Manning, of the Amoskeag Manufacturing Company, Manchester, N. H., and Mr. Hawkins, of the Boston steam engineering school of that name.

International Railway Fuel Association.

Organized in Chicago last November, the International Railway Fuel Association held its first annual meeting in the Auditorium Hotel, Chicago, June 21 to 23. The purpose of the association is to benefit its members in relation to the best methods of purchasing, inspecting, weighing, distributing, handling and accounting for fuel. To be an active member one must be an officer of a railway company or an assistant officer, but men having general knowledge of fuel and fuel economies are eligible as associate members. As the fuel bill of the railroads of the United States is approximately $300,000,000 a year, the association deems that it has an important field. Among the papers read at the recent meeting was one by Mr. C. T. Malcolmson, of Chicago, on "Briquetted Coal, and Its Value as a Railroad Fuel." Other papers were: "How to Burn Locomotive Fuel Coal Successfully," "Difficulties Encountered in Producing Clean Coal for Locomotive Use," "Best Method of Accounting for Railway Fuel," "Correct Weighing of Coal at Mines and on Railroad Track Scales," and "Standard Types of Coaling Stations." The address of President McAulliffe was a thoughtful review of the fuel situation. Officers were elected as follows: President, Mr. Eugene McAulliffe, general fuel agent, Rock Island Railroad, Chicago; first vice-president, Mr. W. C. Hayes, Erie Railroad, New York City; second vice-president, Mr. J. H. Hibben, Missouri, Kansas & Texas Railway, Parsons, Kan.; secretary, Mr. D. B. Sebastian, fuel supervisor, Chicago & Eastern Illinois Railroad, Chicago; treasurer, Mr. J. McNanamy, Pére Marquette Railroad, Grand Rapids, Mich.

While this association is intended mainly for railroad men, it will welcome the co-operation of power-plant owners and all other large fuel consumers interested in the subject of coal testing and the economical production and utilization of fuel.

Convention of Brooklyn Edison Section of the N. E. L. A.

The first annual convention of the Brooklyn Edison section of the National Electric Light Association was held at the Oriental Hotel, Coney Island, June 23. There were nearly 300 members present, and the meeting was presided over by Mr. Geo. L. Knight, chairman. The papers read and discussed were for the most part abstracts of the papers presented at the recent Atlantic City convention of the National Electric Light Association, their purpose being to convey to the members of the Brooklyn branch some of the information and inspiration that were necessarily available directly to only the few who could attend the main convention.

SUBWAY CONSTRUCTION.

The first business was the presentation of an original paper on "Subway Construction," by Mr. J. J. Leddy, of the distribution department of the Brooklyn Company. In this paper the principal features of manufacture of the various types of conduits, cables, etc., installed by the Brooklyn Edison Illuminating Company were described. The process of burning clay ducts has always been one of uncertainty. To determine the temperature of the kilns and to reduce the time of burning to a minimum several of the kilns of the Great Eastern Clay Company have been equipped with the Frink pyrometer. The fiber duct manufactured by the Orangeburg Fiber Company was described in detail from the raw fiber as received from the Canadian forests to the finished product. Mr. Leddy next described the manufacture of the two 1,000,000-circ. mil concentric direct-current feeder cable used by the Brooklyn Edison Company, also the three-conductor 250,000-circ. mil, 6600-volt, three-phase feeder. The former cable is designed to carry 1250 amp at 240 volts for four hours without injury to its insulation. The three-phase feeder cable consists of three conductors having a cross-section of 250,000 circ. mils each. It is tested at the factory at a potential of 15,000 volts alternating current for 30 minutes. Sub-surface construction, drawing-in of cables and jointing were described in a practical manner.

Following the paper by Mr. Leddy, abstracts with comment were given from various papers presented at the National Convention. The presentation of these papers was made by Messrs. G. L. Knight, P. D. Sharkey, F. H. Harrison, J. J. Leddy, E. W. Babcock, C. A. Graves, J. F. Becker, M. S. Seelman, Jr., and J. L. Wiltse. The commercial papers seemed to arouse more interest than the technical ones.

There was an especially interesting and vigorous discussion on the "Relation of Electric Vehicles to Central Stations," a paper presented by Mr. J. T. Hutchings, of Rochester, at the National Convention and reviewed by Mr. Graves. Mr. W. W. Freeman, vice-president of the company, also spoke on this subject, indicating to those present the possibility of helping the work along in this direction.

At the evening session Mr. W. C. L. Eglin made a few remarks on the relations of the parent and branch organizations, and spoke encouragingly of the work that was being accomplished by both. Mr. P. H. Bartlett, of Philadelphia, spoke of the work being done by the Philadelphia section.

The principal feature of the evening session was the address of Mr. Caryl D. Haskins, of the General Electric Company. Mr. Haskins gave a general review of development in the various branches of the electrical field, particularly electric lighting, and cited his own experiences, especially those in England. His references to the then rough and untried methods of attaining results were amusing in the light of present knowledge. He finally considered the fuel and power problems of the future when coal becomes exhausted, and expressed the belief that the utilization of water-power would offer the main solution. The election of officers for the ensuring year resulted as follows: Chairman, Mr. Jos. F. Becker; vice-chairman, Mr. F. W. Harrison; secretary, Mr. E. A. Bailey; treasurer, Mr. F. C. Hill.

Convention of Association of Railway Telegraph Superintendents.

The twenty-eighth annual convention of the Association of Railway Telegraph Superintendents was held at the Hotel Pontchartrain, Detroit, June 23, 24 and 25, with an attendance of about 75 active members. President W. J. Camp, of Montreal, presided, and at the opening of the meeting the delegates were welcomed by the Mayor of Detroit and the vice-president of the Detroit Board of Commerce.

After disposing of routine matters, Mr. W. K. Morley, of Grand Rapids, the first president and organizer of the association, addressed the convention. He told of the steps which led to the formation of the association 27 years ago, it being the outgrowth of monthly meetings held in Chicago in the office of Mr. F. H. Tubbs, superintendent of the Western Union Telegraph, of telegraph superintendents having their headquarters in and about that city.

Among the reports presented at the convention was one on "High-Tension Wire Crossings," prepared by a committee consisting of Mr. G. A. Cellar, chairman, and Messrs. G. H. Groce and Charles Selden. The report recommended 700 volts as a dividing line between high-tension and low-tension work, and specifications were given for overhead and underground crossings of wires carrying 700 volts or over, and also for less than 700 volts. A paper, entitled "Preservation of Poles," was then presented by Mr. H. P. Folsom, and led to an interesting discussion.

FOLSOM PAPER.

The paper by Mr. Folsom opened with a discussion as to the cause of decay of poles at the ground line. The conclusion was that it is the result of a fungus growth, and that the germ attacks the pole from the outside and not the inside. The paper is largely devoted to a description of a patented method for arresting the decay of poles, and full details are given as to its application. Briefly, a hole about 14 in. deep is dug about the pole, a layer of Portland cement placed at the bottom of the hole, and the surface of the pole cleaned to a point somewhat above the level of the ground. Next a jacket made from a sheet composed of asbestos and asphaltum is placed about the pole, leaving an annular space of about 2 in. deep, which is filled with a germicide in a dry state mixed with sand. The germicide consists of slacked lime, common salt and a small quantity of sulphate of copper. Around the top of the jacket a cap or collar of Portland cement is formed, this being reinforced, if desired, with old telegraph or telephone wire. This collar protects the chemicals and jacket from the action of the rain and snow, and also protects the pole against grass fires. It is stated that the chemicals are slowly dissolved by the natural moisture in the pole, and pass into the same by the action of capillary attraction, thus destroying the fungi and wood-eating insects. A gang of three men can treat from 20 to 30 25-ft. poles per day at a cost of about 75 cents to $1 per pole, including royalty. Very large poles costing from $50 to $75 have been treated at a cost ranging from $1.50 to $2.50. It is stated that poles thus treated when they were partially decayed have, after nine years, shown no increase of decay, and that the protecting device is still in good condition.

In the discussion of the paper Mr. J. McMillan, superintendent of telegraph construction of the Canadian Pacific Railway, at Calgary, Alberta, stated that in part of his territory the decay of poles, instead of beginning at the ground line, starts 4 ft. or 5 ft. below the surface.

Other papers presented were as follows: "Telephone Construction," by Prof. J. C. Kelsey, which included data and specifications for standard work; "Efficiency of Office Organization," by Mr. J. B. Sheldon, of Omaha, superintendent of telegraph of the Union Pacific Railway; "Wire Testing and Care of Wires," by Mr. V. T. Kissinger, Lincoln, Neb., assistant superintendent of telegraph of the Burlington system; "Difference Between a Trouble-shooter and a Division Lineman," by Mr. H. D. Teed, of St. Louis, superintendent of telegraph of the St. Louis & San Francisco Railroad, and "Dry Batteries," by Mr. F. H. Loveridge, of Chicago. Exhibits of telegraph and telephone apparatus and supplies were displayed in rooms of the Hotel Pontchartrain by a score or more of manufacturers and dealers.

Following are the officers elected for the ensuing year: President, Mr. John L. Davis, of Chicago, superintendent of telegraph of the Chicago & Eastern Illinois Railroad; vice-presidents, Mr. I. T. Dyer, of Los Angeles, superintendent of telegraph for the San Pedro, Los Angeles & Salt Lake Railroad, and Mr. George A. Cellar, of Pittsburgh, superintendent of telegraph of the Pennsylvania Lines West of Pittsburgh; secretary and treasurer, Mr. P. W. Drew, of Chicago, superintendent of telegraph of the Chicago division of the Minnesota, St. Paul & Sault Ste. Marie Railroad.

It was voted to hold the annual convention next year at Los Angeles about the middle of May.

Nunn Building at Cornell.

For the purpose of maintaining at Cornell University a number of students who are to pursue research work in engineering, Mr. L. L. Nunn, of Telluride, Col., is building on the Cornell campus and will endow a clubhouse in which the investigators that he sends to Ithaca are to live. The house is to be situated directly north of the Delta Upsilon house, near West Avenue.

Mr. Nunn is one of the pioneers in electrical power transmission, and well known from his connection with the Telluride and allied plants in Colorado and Utah; one of the great Niagara Falls power developments is also due to his initiative. For years past electrical research work of an advanced kind has been done in connection with the operation of the Nunn plants, which work has had a notable influence on the advancement of electrical power transmission, particularly with respect to the use of higher and higher voltages, and switching arrangements. It is understood that Mr. Nunn wishes now to have this work, so far as possible, done where the results can be assured of permanent scientific as well as of immediately economic value, and that he has selected Cornell University for this purpose.

From the university trustees Mr. Nunn has obtained a lease of ground north of the Delta Upsilon house, and he is there erecting a dormitory. The plans provide for a three-story and basement structure measuring about 45 ft. x 90 ft. It will be somewhat like a fraternity house, with living rooms on the first floor and about 20 sleeping rooms on the two upper floors. It will be finished, if possible, so as to be put to use when the university reopens next fall. The house, it is stated, will be endowed by Mr. Nunn.

Bell-Independent Telephone Toll Contracts in Ohio.

The Bell telephone people are reported to have completed long-distance connections with the independent exchange at Willoughby, a town east of Cleveland. It is reported that a contract has also been signed with the United Telephone Company, of Bellefontaine, Ohio. Further, the Bell interests claim to have several other contracts with independent companies ready to sign. This, it seems, is the beginning of the warfare to be waged under the recent decision of Judge Robert W. Tayler, of the United States District Court. For a time it was thought that both sides would be slow to move into each other's stronghold, for the decision applies both ways. The United States Telephone Company may force connections with the Bell local exchanges on the same basis as the Bell connects with independent companies, if the decision is understood rightly. It seems that a local company which has long-distance connections with another company cannot deny connections with still others on the basis that the first one was admitted to take business. It only depends upon whether the companies desire to enter such a contest.

Boston Street Lighting Contract Sustained.

Corporation Counsel Thomas M. Babson, of Boston, has given an opinion that Mayor Hibbard and Superintendent of Streets Emerson acted entirely within their legal rights in signing the recent street-lighting contract with the Edison Electric Illuminating Company. It was recently claimed that the Board of Aldermen's consent was necessary to the making of such a contract. Mr. Babson cites statutes forbidding any member of the city government to take part directly or indirectly in the making of a contract. The superintendent of streets has employed methods of lighting which have been approved by the Board of Aldermen, which has favored the use of electricity, gas and naphtha in the past. Mr. Babson stated that there is no doubt about the right of the Mayor to make a contract for the smaller street lighting upon the basis of bids scheduled to be opened June 28. The legislative powers of the City Council are confined to such matters as the approval of pole locations and heights.

Plant Extensions at Cedar Rapids, Iowa.

Extensive additions to the plant of the Cedar Rapids & Iowa City Railway & Light Company, of Cedar Rapids, Ia., are to be made, and plans for the work are being prepared by H. M. Byllesby & Company, of Chicago. The boiler-room of the station will be completely remodeled, and new boilers, having a capacity of 1400 hp, will be installed. These boilers will probably be equipped with automatic stokers, and the necessary pumps, etc., will also be needed. It is probable also that coal- and ash-handling apparatus will be installed. A new steel chimney, 10 ft. in inside diameter, will be built. The plans also provide for the addition of three 2000-kw turbo-generators in the engine-room. The present engine-room equipment consists of a 1500-kw Allis-Chalmers turbo-generator, a 800-hp Fulton engine driving a Bullock generator, and a 400-hp Buckeye engine driving a Westinghouse generator. The president and general manager of the Cedar Rapids & Iowa City Railway & Light Company is Mr. William G. Dows, and the manager of the lighting department is Mr. W. J. Greene.

Space Between Passing Street Railway Cars.

At a meeting of the Chicago City Council committee on local transportation, on June 23, Mr. George Weston, the member of the Board of Supervising Engineers representing the city, presented a communication on the subject of clearance between passing street-railway cars in Chicago. As readers of this journal are aware, this subject is attracting much attention owing to accidents which have caused the death of a number of persons by being crushed between passing cars on the "death strip," as it has been called, left between passing cars by the present standard type of construction in Chicago. Mr. Weston gave an account of the extended consideration which the board has given this subject. The question relates to the distance to be left between track centers, width of the cars and the space remaining for wagon traffic between the sides of the cars and the curb, which is, of course, particularly important in narrow streets.

Although at one time he coincided with other members of the board in favoring the narrow space, Mr. Bion J. Arnold, chairman of the board, now advocates a space of 20 in. between passing cars, to be obtained by increasing the distance between track centers from 9 ft. 8½ in. to 10 ft. 2 in., and by reducing the width of the cars from 9 ft. to 8 ft. 6 in. This would leave a space of 20 in. between passing cars. Mr. Weston believes that the clearance between cars, to be perfectly safe, should be not less than 30 in. He is not convinced that the net results for safety would be greater with a 20-in. space than with an 8½-in. space. Many persons who have studied the subject, he says, believe that a 20-in. space would result in a condition that would invite people to seek refuge in the space, with the result that very likely they would be knocked down and dragged under the cars, thereby increasing the number of crossing accidents.

Mr. Weston says that this is not a technical question and that he has interviewed a number of crossing policemen on the subject. In every instance these men said that if the space cannot be widened enough to be safe, it would better remain as it is. On the other hand, it is self-evident that a man caught in an 8½-in. space will be crushed, whereas, in a 20-in. space, he would have a chance for his life. As to the distance between cars and curb the minimum should be 9 ft. 8 in., in Mr. Weston's judgment, particularly in the business streets with a 38-ft. roadway, because with the ordinary delivery wagon backed up to the curb, the space mentioned is just sufficient to allow a car to pass.

While Mr. Weston is doubtful, he appears now to be willing to try the 20-in. space. Mr. H. B. Fleming, of the Chicago City Railway Company, is believed to have favored the 8½-in. space from the first. Mr. Arnold, as pointed out, has been converted from the 8½-in. space to the 20-in. space. Mr. John Z. Murphy, the remaining member of the board representing the Chicago Railways Company, favors the 20-in. space. Mr. Murphy is a large man, but he has stood between passing freight cars with a 20-in. clearance. He says that no man who keeps his head need be killed if caught between passing cars with a 20-in. clearance. The present agreement seems to be that there should be no further extensions having the 8½-in. clearance. The subject will be further considered at a future meeting of city officials, members of the board and officers of the traction companies.

In the discussion of this subject in the daily newspapers there has been much diversity of opinion. Teaming interests do not want the space between cars and curb contracted in narrow streets. One suggestion is that the space between tracks should be widened only at street intersections and for a short distance on either side, leaving the width between tracks in the middle of the block as at present. Another is that cars carry conspicuous signs reading: "Look Out for Passing Cars," or "Death Between Passing Cars." A number of other suggestions have been offered. The general opinion seems to be, however, that a 20-in. clearance would at least offer an adult person a chance for his life if caught between cars, whereas, with an 8½-in. clearance, he would be almost sure to be killed, and, therefore, that the wider space (although still narrower than the clearance required for absolute assured safety) should be adopted.

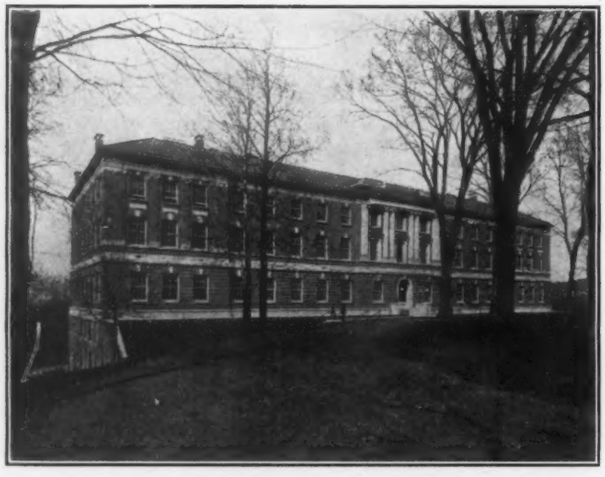
Rensselaer Polytechnic Engineering Laboratory.

At the eighty-third commencement of the Rensselaer Polytechnic Institute, on June 15, the Russell Sage engineering laboratory was formally opened. The laboratory is the gift of Mrs. Russell Sage, and cost, with its equipment, $405,000. Of this amount $300,000 was taken from a donation of $1,000,000 made by Mrs. Sage, the remaining $700,000 being reserved as an endowment fund. Among those present at the exercises were Prof. Dean F. A. Goetz and Prof. W. H. Burr, of Columbia University; Prof. H. W. Spangler, of the University of Pennsylvania; Mr. E. W. Rice, Jr., vice-president of the General Electric Company, and Mr. L. B. Stillwell, president-elect of the American Institute of Electrical Engineers.

Courses in mechanical and electrical engineering were instituted at the Rensselaer Polytechnic Institute last year in pursuance to a resolution adopted by the board of directors in March of that year. Dr. W. Lispenard Robb is in charge of the electrical engineering department. The laboratory, which is shown in the accompanying illustration, consists of a central portion 50 ft. wide by 100 ft. deep, and two wings each 100 ft. wide and 80 ft. deep, the building being four stories in height. The east wing contains the department of electrical engineering, and the west wing that of mechanical engineering, the central

portion being devoted to a large lecture room, reference library, museum and drawing-room. The principal addresses delivered during the exercises were by Mr. Jesse M. Smith, president of the American Society of Mechanical Engineers, and Mr. L. W. Stillwell, president-elect of the American Institute of Electrical Engineers.

Mr. Stillwell in sketching the growth of the industrial arts said that, while practice in America in the mechanical and electrical arts compares favorably as a whole with that of any other country, the discovery of the facts upon which practice is based has been more often European than American. Even in the practical application of physical sciences it happens not infrequently that we follow and do not lead. While the United States takes high rank in technical education, a point has been reached where scientific methods and scientifically trained men are needed as they never have been needed before. From now on the industrial and commercial progress must depend more upon refinements of practice and less upon the expansion of new fields; and to the attainment of such refinements the knowledge and training that students will have an opportunity to attain in the laboratories of the technical schools are factors fundamentally essential. Training imparted in laboratories such as that being dedicated preëminently fits men, not only to be mechanical and electrical engineers, but also to attack with success the economic and essentially scientific problems which arise in almost every department of the manufacturing industry. In the electrical field there is constant need of more workers,



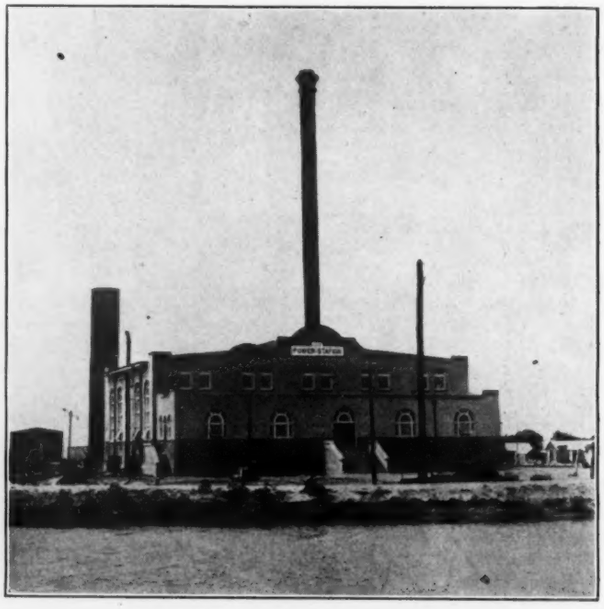
RENSSELAER POLYTECHNIC ENGINEERING LABORATORY.

and especially of trained workers. For many years to come the demand for mechanical and electrical equipment will continue to increase at a rate exceeding the average rate of increase for other manufactured products, and consequently the field for trained workers in the practical application of mechanical and electrical sciences is an expanding one.

But the actual field available for graduates of an institution like the Rensselaer Institute is much wider than would be gathered from a mere consideration of those spheres of effort which are regarded as peculiarly the province of the engineer, owing to the fact that no other training so well fits a man for success in the many more or less closely related departments of practical industry. Moreover, beyond the great value of an engineering laboratory as a school for training students in engineering courses lies another possible, and even probable, greater value—the opportunity which it affords, and the stimulus which it may be expected to impart to latent talent in the fascinating and wonderful field of original research. Mr. Stillwell expressed the hope that among the young men destined to work within the walls of the Sage laboratory some will be found whose preference would be for pure science rather than for its applications, and whose patient research work in later years will result in further additions to the still far from complete basis of scientific knowledge upon which present engineering practice rests.

Electric Pumping for Irrigation.

The water for the great system of canals and ditches of the Mercedes, Tex., irrigation system is pumped from the Rio Grande by means of electrical energy which is supplied from a central power plant situated in the town of Mercedes, seven miles from the pumping station. The Mercedes enterprise will be one of the largest electrical pumping irrigation propositions in the world when the plans are fully rounded out. Water will be supplied for more than 200,000 acres of land, situated in the valley of the lower Rio Grande. The central power plant at present generates at 6600 volts, the three-phase currents being transmitted to the pumping station, situated upon the bank of the river, seven miles distant, and operates an induction motor-driven pump, which has a capacity of 60,000 gal. per minute. The equipment of the central power plant consists of two generators of 300 kw each and a 15-kw lighting set for the town of Mercedes, when the main set is shut down. The main canal of this system is already completed for many miles across the valley land, and carries a stream of water 145 ft. wide and 10 ft. deep. The canal is capable of being navigated by barges and



ELECTRIC PUMPING FOR IRRIGATION AT MERCEDES, TEX.

boats. There are a number of other small electric pumping plants along the upper course of the Rio Grande River, particularly in the vicinity of Laredo, where a number of farmers receive electrical energy for operating their respective pumping stations from the electric power plant in the town.

New York Public Service Commission News.

The Public Service Commission of the First District of New York has addressed a letter to the Board of Estimate and Apportionment, asking for authority to advertise for bids on all the subway routes which were laid out by the old Rapid Transit Commission. The routes mentioned in the letter include the Lexington Avenue, the River Avenue, the Rome Avenue elevated, the Southern Boulevard and Westchester Avenue, the Canal Street, the Manhattan Bridge routes and the Brooklyn Loop line from the Williamsburgh Bridge to Ashland Place in Brooklyn. It also desires authority to make contracts for the equipment and operation of the Fourth Avenue, Bensonhurst, Bath Beach and Coney Island route, contracts for which have already been let by the city, and to contract for the operation of the Manhattan Bridge loop. This action, which is in the nature of forcing the hand of the Board of Estimate, contemplates the construction of more than $100,000,000 worth of

new subways, and the expenditure of a like amount for equipment. The commission suggests that bids be asked for this work under the three forms now permitted by law; by public money, by private capital and by assessment of the property owners benefited by the subways. The Board of Estimate has not yet taken any action on the matter, but promises that it will consider it at an early date.

The Public Service Commission has not as yet received any new subway plans or proposals from the Interborough Rapid Transit Company, although it has been notified that these plans are being matured and will be offered within a very short time. It is stated that when the Interborough's new proposals are made they will practically cover all of the subway routes authorized by the old Rapid Transit Commission.

The case brought in the Appellate Division of the Supreme Court of the city of New York, by the South Shore Traction Company against the Public Service Commission, to test the latter's right to withhold its approval of the franchise already granted by the Board of Estimate and Apportionment, was argued last week by counsel for the two principals, and also by the corporation counsel of the city. There is a desire on all sides to push the matter to an early conclusion, and to get a decision settling the commission's authority before the adjournment of the courts.

At a hearing before Public Service Commissioner Maltbie, in a continuation of the investigation of electric light and power companies of New York City, Messrs. A. H. Larkin and James H. Sims testified as to the franchises of the Richmond Light & Railroad Company. A map covering these franchises has been prepared by the chief of the commission's franchise bureau, Mr. Delos F. Wilcox. It was shown in the testimony that the present company succeeded to the rights of the Richmond County Electric Light Company, which itself was a consolidation of a number of local companies, such as the Port Richmond Electric Light Company and the New York & Staten Island Electric Company. These smaller companies owned franchises and contracts for public lighting, which had been granted by village and town authorities and by highway commissioners. It was claimed by the witnesses that under the rights derived from these companies which were absorbed, that the Richmond Light & Railroad Company now possesses franchises and contracts covering the entire Borough of Richmond. The investigation is but one step in the commission's work of making a thorough record of all existing franchises for light and power in the territory under its jurisdiction.

The Public Service Commission has disapproved of the type of wheelguard now in use on the Second Avenue Railroad, New York. The guard, which is known as the "Pilot Fender," does not, it is claimed, operate close enough to the ground.

Mayor McClellan has notified the Board of Estimate that he has approved the franchise of the Hudson & Manhattan Railroad Company for the extension of its lines under Sixth Avenue from Thirty-third Street to the Grand Central Station. Mr. McAdoo, president of the road, states that work will be begun as soon as sufficient property agreements can be secured, and predicts that trains will be running in the new tube by 1911.

The Public Service Commission of the Second District of New York has given authority to the Westchester Lighting Company to purchase the entire capital stock and bonds of the Northern Westchester Lighting Company, and the common stock and bonds of the Peekskill Lighting & Railroad Company. This practically sanctions the merger of all of the lighting properties in the northern section of Westchester County under one management. The Westchester Company is controlled by the Consolidated Gas Company, a Standard Oil interest.

Peoria Electrolysis Case.

Another stage of the important and long-drawn-out litigation usually referred to as the "Peoria electrolysis case" was reached on June 22 when Mr. Frank L. Wean, of Chicago, as special master in chancery, filed a second report to the United States Circuit Court for the Northern District of Illinois. The complainant in this case is the Peoria Water Works Company and the defendant is the Peoria Railway Company. The suit, which has been pending in one form or another, for perhaps 15 years, arose out of the damage to the plaintiff's buried water mains alleged to be due to escaping current from the defendant's return electric circuit. It has attracted wide attention among electric and street-railway men, owing to similar allegations of damage to water pipes and other buried metallic structures from escaping electricity in other cities. The second reference to the master was to determine, among other things, what remedy could be applied to minimize or prevent the injury complained of.

The master reports that in March, 1908, the railway company was operating about 50 miles of single-track railway in Peoria and vicinity. The rails in use were largely of the girder type, 7 in. high, 60 ft. long and weighing 80 lb. to the yard. In the business portion of the city these rails were laid on hardwood ties embedded in concrete, with the space between the rails and adjoining the rails paved with brick. The return system consists of the rails bonded at each rail joint with two No. 0 copper wires in the manner known as "channel-pin bond." At the time mentioned the "brazed bond" had been applied to about three miles of track. This "brazed bond," according to the evidence, is one of the most efficient devices for continuing the electric conductivity of the rail return at joints, but is no more efficient, says the master, than the welded joint or certain other methods of bonding which have been in use for a long time. Where special work existed the rails were cross-bonded. The defendant also had as a part of its return about six miles of negative overhead wires running from its power station to different parts of the system. These wires were connected with rail and tracks at one end and at the other to the negative bus-bar in the power house.

Since the close of the defendant's evidence on the former hearing, the railway load has perhaps doubled, and although the conductivity of the return has been improved by heavier rails, double rail bonds, cross-bonding, additional negative return feeders and, so far as it has been applied, the brazed bond, still the master finds it is more difficult to prevent the escape of electric current to the water pipes of the complainant owing to the increased traffic and the passage of large interurban cars. The master holds that the evidence shows that notwithstanding all preventive means adopted the current flow on the water-works system has gradually increased; a portion of the current has continued to escape and work damage to the proximate underground metallic structures.

The master says that in many cases the complainant's water mains have been injured and in some cases rendered useless by the return current of the railway company. In these distributing mains since 1893 there have been discovered 119 joint leaks in 30-in. mains, 14 in 20-in. mains, 43 in 16-in. mains and 47 in other mains. Two breaks have occurred in 30-in. mains and nine in 20-in. mains. Electrical surveys made as late as March 25, 1908, showed the most current flowing on the pipes in about the places where the greatest number of joint leaks and breaks occurred. The pittings in the mains, caused by flow of electricity from the defendant's system, have been constantly increasing in depth, according to the master. On South Adams Street, where the depth of a pitting, according to the evidence at the former hearing, was ⅛ in. in March, 1908, instances were found where the depth of the pitting was 0.55 in. in a main having metal normally ⅞ in. thick.

The defendant offered witnesses who testified that all danger could be prevented by the use of the brazed bond on all rail joints in addition to the present bonding, together with proper cross-bonding and "jumpers" and proper maintenance of overhead negative return wires. On cross examination some of these witnesses testified that the plan proposed could not wholly prevent the escape of electric current, but that the amount escaping would be so small as to do no damage. The complainant's witnesses controverted this position. The master's finding is as follows:

"The evidence offered on this re-reference fails to disclose

any method which will completely or substantially prevent the injury complained of; and all the evidence fails to disclose the discovery, since the hearing under the previous order of reference, of any new principle or fundamental law, regarding the nature and effect of electric current or of any new method of preventing the escape of such current different in principle from those known at the time of the former hearing. In other words, the evidence on this reference, taken as a whole, tends to confirm the findings stated in this special master's former report."

The former conclusions which the master fails to change are in effect that a difference in potential of a fraction of a volt may cause electrolysis, and from the conditions found the ultimate destruction of the complainant's pipes by electricity escaping from the defendant's system is said to be a question only of time and pressure. Further, no method is disclosed by which the complainant, by its own action, can protect itself from the electric currents of the defendant's single trolley railways. Entire removal of electric current from the water mains is impossible, in this case, as long as the return currents are grounded or in electric contact with the earth.

Objections to the master's report have been filed by the defendant's counsel, Mr. John P. Wilson, of Chicago, and Mr. I. C. Pinkney, of Peoria, who contend that many of the findings of the master are contrary to the evidence, particularly the statement that it is more difficult to prevent the escape of current since the former hearing, owing to the increase of traffic and the passage of large interurban cars. Categorically, findings as to injury to pipes, pitting and the alleged injury to the complainant's distributing system are objected to as being contrary to the greater weight of evidence.

The next step in this litigation probably will be a motion by the complainant's attorneys to have the master's report confirmed by the court. Undoubtedly the judge hearing that motion will take the case under advisement, and it will probably be some time before the court's decision is announced. Accompanying the master's report was about 1000 pages of typewritten testimony taken on the re-reference.

Internal Combustion Engine Trades Convention.

The National Gas and Gasoline Engine Trades Association held a three days' convention in South Bend, Ind., June 22, 23 and 24, closing with a banquet at the Oliver Hotel. The opening session was called to order by the president, Mr. H. T. Wilson, of Middletown, Ohio. Mayor Fogarty tendered a cordial welcome to the visitors and a happy response was made by President Wilson. The convention then took up the first paper on the program, entitled "Storage Batteries for Ignition Purposes" by Mr. G. L. Chandler, of the Willard Storage Battery Company, of Cleveland, Ohio. This was followed by a paper by Mr. Charles Kratsch, of Chicago, on "Gas Engines." These papers formed the subjects for discussion for the first session, which was participated in by a goodly number of delegates.

At subsequent sessions a number of interesting papers were presented, among them being one entitled "The Suction-Gas Producer for Small Power Plants," by Mr. C. J. Atkinson, followed by a paper on "Gas Engine Construction for Producer Gas Use," by Mr. H. F. Smith. Both papers were interestingly discussed. The "Advantages and Disadvantages of Selling Gas Engines Through the Jobbers and Dealers" was clearly defined in a paper read by Mr. M. F. Bates, and "Twenty Years as a Gas Engine Jobber" was the subject of an interesting paper presented by Mr. J. N. Shoemaker. The incidents and experiences brought out by these papers awakened quite an interesting discussion. "Jump-Spark Coils for High-Compression Engines" formed the subject of an illustrated talk by Mr. J. A. Williams. "Dry Cell and the Advantages of Multiple Batteries for Ignition" were treated in a paper by Mr. A. L. Haskell, and provoked an extended discussion.

After adopting a resolution of thanks to the Oliver Hotel, the city press and the committee of entertainment, headed by Mr. O. M. Knoblock, and others who had done so much to make the convention a great success, the entire party of 100 or more was taken on a trolley excursion to St. Joseph, Mich., by and through the courtesy of *Gas Power*, the trade journal published at that place. The next meeting place was left with the board of directors, and the date will be some time in December. The officers of the association are as follows: Mr. Harry T. Wilson, Middletown, Ohio, president; Mr. M. A. Loeb, Cincinnati, Ohio, vice-president; Mr. Otto M. Knoblock, South Bend, Ind., treasurer, and Mr. Albert Stratmatter, Cincinnati, Ohio, secretary.

The Late Charles L. Buckingham.

The death of Mr. C. L. Buckingham, which occurred May 31, and was noted in the *Electrical World* of June 10, suggests a somewhat more extended sketch of his career as a lawyer and electrical engineer.

Charles Luman Buckingham was born Oct. 14, 1852, in Berlin Heights, Ohio; the son of George and Ariadne (Andrews) Buckingham. He was the eighth in descent from Thomas Buckingham, the founder of the American family and one of the Puritans who, in the year after his landing at Boston (June 26, 1637) founded the city of New Haven, and subsequently settled Milford, Conn., in 1639. A son of this pioneer, through whom the subject of this sketch descended, was the Rev. Thomas Buckingham, one of the founders of Yale College in 1700. After the early death of his father, Charles was graduated in 1875 from the University of Michigan as a civil engineer, and acted for four years as an examiner in the Patent Office at Washington. During this period he pursued a course at the law school of the Columbian University, from which he was graduated as bachelor of laws. In 1880 he took the position of advisory expert and assistant counsel for the Western Union Telegraph Company, which position soon became that of patent expert and counsel.

Thus Mr. Buckingham came into the field of electrical patent litigation at a time when very few lawyers possessed any knowledge of the theory and practice of electrical generation, distribution or utilization. Very early in his work in that field he demonstrated his capacity to grasp readily the most complex conditions of operation and the mathematical expressions of those conditions and, thus fortified, to conduct without electrical expert assistance the cross-examination of specialists in abstruse cases. His record is so notable that the story of his labors in that field may be said to be closely interwoven with the history of successful patent litigation, and the results of those labors have shaped to a material extent the commercial development of the telegraphic, electric light and electric power branches of the modern art.

His first important work for the Western Union Company was with E. M. Dickerson in the famous case of Gold & Stock Telegraph Company vs. Commercial Telegram Company et al., for infringement by the latter's stock-tickers, of reissue patent No. 3,810 to Edward A. Calahan, dated Jan. 25, 1870, in which suit application for preliminary injunction was argued before Judge Wallace, June 13, 1884, and a permanent injunction granted by Judge Shipman, April 1, 1885 (23 Fed. Rep. 340), restraining the Commercial company from further use of its tickers. This early triumph was the more notable because of the array of opposing counsel, including Roscoe Conkling, David Dudley Field and Samuel A. Duncan. Later, in 1885 to 1887, the Western Union sued the Baltimore & Ohio Telegraph Company for infringement of the Stearns divisional reissue patents Nos. 10,033, 10,034, 10,035, dated Feb. 7, 1882, involving the use of condensers in duplex and quadruplex telegraphy, an element so important that the continued existence of the defendant was the real issue in the case. As a result, the Baltimore & Ohio sold out to the complainant company. In 1892-1894 the cases brought by the Magnetic Separator Company against the International Ore Separating Company and William D. Hoffman, re-

spectively, under several patents of Ball, Norton & Porter, resulted in injunctions after final hearing.

Mr. Buckingham's experience in the exhaustive analysis of telegraph patents and apparatus doubtless led to his own conception of the rapid telegraph system which he invented and developed during the time of his connection with Western Union affairs, and with which his name is so intimately associated that his patient and original labors in this direction need be referred to only briefly. His U. S. patents on this system and apparatus are about 25 in number, issued at various times from No. 487,981, Dec. 13, 1892, to No. 880,275, Feb. 25, 1908. His corresponding foreign patents remained in his hands at the time of his death.

But it was as counsel for defendant that Mr. Buckingham exhibited his full power and attained his full measure of reputation. One of his first cases of this kind was Postal Telegraph-Cable Company vs. Delaware and Atlantic Telegraph & Telephone Company. In the case of Brush Electric Light Company vs. Schuyler Electric Light Company his record in defense was so evidently conclusive of the weakness of the patent at issue that the Brush company never forced the case to a hearing. In the later suit of Edison Electric Light Company vs. New Haven Electric Light Company for infringement of the Edison three-wire generation and distribution patent No. 274,290, dated March 17, 1883, which was so generally feared and respected that it lived out its 17 years of great usefulness without being judicially sustained, Mr. Buckingham searched the archives of the principal patent offices of the world and held the situation until the consolidation of 1892, in which this patent played an important part, brought the contestants together in the General Electric Company, and terminated the suit before the rebuttal testimony was commenced.

Quickly following that merger he was retained by the consolidated interests to defend the suit of Westinghouse Electric & Manufacturing Company vs. Thomson-Houston Electric Company filed May 24, 1893, for infringement of the Tesla basic multiphase generation, distribution and motor patents Nos. 381,968 and 382,280, which had, in the five years following their date of issue, come to represent so vital a factor in electrical transmission of power. He represented the defense of the suit of Siemens & Halske Electric Company of America vs. Metropolitan & West Side Elevated Railway Company, a customer of the General Electric Company, on the strongest of the Siemens patents, No. 324,176, covering rheostatic control of electric motors. Still later, Dec. 2, 1897, came the defense in the suit popularly known as the Hutin & Leblanc case against the General Electric Company, which, after four years of preparation, was ready for hearing when the contest was given up and settlement out of court was reached.

Just before his departure for Europe last year in an effort to regain his health, Mr. Buckingham completed his defence in the case of Harry Ward Leonard vs. General Electric Company, patent No. 478,344, for multi-volt motor control; a suit well illustrating his tireless pertinacity in searches for prior public uses beyond the information possessed by the Patent Office.

For over 12 years prior to his death Mr. Buckingham had been in charge of the defence of 12 suits under three Schlesinger patents, of which the most important, No. 546,059, claims the use of a certain arrangement of feeding conductors in a system of electric railway distribution. His last work was on the defendant's brief in the principal suit of this group, preparatory to its expected final hearing in July; also the closing of four years' work in the Edison litigation, New York Phonograph Company vs. National Phonograph Company and Thos. A. Edison, by a settlement which leaves the entire manufacture and the commercial business in the management of Mr. Edison and his organization. To this important phonograph issue (in which he was assisted first by Mr. Charles M. Hough, now Justice of the U. S. District Court, and afterward by ex-Justice William H. Wallace) Mr. Buckingham gave his unremitting efforts during the last year or more of failing strength, undermining his remarkable physique. Even after being forced to leave his office, he kept on his feet until the fourth day before his death, when he was compelled to give up the unequal fight.

Deprived by the death of his wife nearly 20 years ago of the full measure of home life and domestic enjoyment which under ideal conditions constitute the relaxation from persistent business activity which is so important to the prolongation of usefulness in this strenuous age, Mr. Buckingham devoted himself unreservedly to the detail of his legal cases, with only occasional respite in short trips to Europe, or visits to his aged mother in Ohio, or days in the society of his boys during their school life, or evenings with his small circle of close friends whom it seemed to delight him to entertain in his inimitable way.

This concentration of his great personal strength and energy upon his deliberate and exhaustive methods of analysis and accumulation of masses of evidence and judicial opinion to support his positions, made him one of the most formidable opponents at the American Bar. Always genial and courteous, he possessed in an eminent degree that indomitable persistency which looks upon obstacles less as a discouragement than as a stimulus to greater endeavor. It never appeared to occur to him to place limitations upon his own endurance or that of those associated with him. He was intemperate only in the persistency of his labors, and failed in generosity only in his requirements of those who were under his command in his struggles for victory. He could not refuse the appeal of human distress, and the maintenance of anything but a fair, open warfare was utterly foreign to his nature.

As early as 1894 the late Henry Morton, then president of the Stevens Institute of Technology, in speaking of the high position which had been attained by Mr. Buckingham in his chosen profession, said:

"His success is largely due to the prodigious amount of work he is capable of performing. He is conscientious in thoroughly mastering the details of his cases, which often involve an amount of study and labor quite beyond the reach of the general practitioner. His scholarly research in matters pertaining to his specialty is profound and comprehensive, and is the admiration of all familiar with the subject. It is particularly apparent in his numerous writings on telegraphy, all of which indicate entire familiarity with the subject of electricity in all its relations."

The loss which the legal profession has sustained was tersely expressed by His Honor Mr. Justice Lacombe in granting a motion made by Justice Hough at the memorial service held in the United States Circuit Court for the Southern District of New York on Friday, June 11, in these strong words:

"As the years go by these mournful occasions present themselves and give notice to us all that we are moving on. The Court feels it unnecessary to add anything to the remarks which have been made here, except to express in behalf of the whole Bench the sense of loss which we feel and an appreciation of the fact that our friend will be no longer before us. His ability was of the very highest order, his presentation of his cases always earnest and extremely luminous, and impressed as he was with the very highest ideas as a lawyer and as a man, his loss is one to be deplored. The clerk will make the proper entry in the minutes."

Mr. Buckingham became a charter member of the American Institute of Electrical Engineers on April 15, 1884, when its first meeting was held, and the following year he was elected a manager and served one term on the Council (now called the Board of Directors), 1885-8. He was one of five who purchased for donation to the library of the Institute a valuable classified collection of all the United States electrical patents issued down to 1891, numbering more than 100 volumes. He was also a member of the American Association for the Advancement of Science, the American Academy of Political and Social Science, the Metropolitan and Union clubs of Washington, and the Engineers' Club, University Club and Ohio Society of New York.

Mr. Buckingham's mother, Mrs. A. A. Hopkins, survives him. She is a woman of exceptional attainments and character. His older son, Harry, married the daughter of his

father's college classmate, Prof. R. C. Carpenter, of Cornell University, and has lived for some time in the far West. The younger son, Charles, is just completing his freshman year at Yale. *W. J. J.*

It is difficult for one who enjoyed the confidence of the late Charles L. Buckingham to speak or write with moderation concerning his amiable qualities as a friend and his admirable character as a man. He was a strong, forceful personality; generous in the old sense of the term, and unfailing in every obligation of friendship, often going far beyond the conventional requirements of such a relation and interpreting by his own large nature his duties toward one in whom he took a personal interest. He never received a favor which he did not endeavor to requite in multiple; and somewhere within him must have lain the feeling that a kindness shown to him was something which was beyond his power of repayment.

The bigness of the man was evident in his powerful frame, his hearty voice, his straightforward manner, and all his methods of dealing with his associates or opponents. There was never any doubt as to what his opinions were, and no one engaged in controversy with him could ever have suspected underhand modes of treatment, however he might dread the strength of the opposition which he was certain to encounter.

Besides being a good friend, Mr. Buckingham was an equally good enemy. He had a strong lust for battle, but it was fair fighting and no favor. If he made a hostile move, it was only after an open declaration of hostility and according to all the rules of civilized warfare. He was too self-reliant for petty envy, but he did not spare an opponent through false sentiment. His rule was to play the game. He was ambitious to win and he used all the legitimate methods at his command to secure that end.

In the opinion of those who were most familiar with his work as a patent lawyer, he was one of the leading members of the Patent Bar, and as counsel for the defense in patent litigation, a position for which he was especially suited by nature and training, it is doubtful if he has ever had a superior among American lawyers.

While it may have seemed to his opponents in many instances that he carried too far the resemblances and analogies appearing in the prior art as compared with the patent in suit, yet no one could question the fact that the defense which he built up was the strongest possible rejoinder to the claims set up in a patent suit. He was fruitful in expedients for taking every fair advantage of the circumstances. There was little, if anything, remaining to be done when his case was in final shape.

This does not necessarily mean that Mr. Buckingham was always successful in his patent litigation work, but it means that he made the best possible use of the materials at hand; and it is a fact well known among the members of the Patent Bar that, on the strength of the defense set up by him, suits were often compromised in preference to taking the risk of carrying them to final hearing.

In his professional work he pursued methods of his own, some of which have been derided by lesser men. His preparation for the conduct of a case fas most thorough in every detail.

Nothing was too small to escape his notice, provided it had a bearing upon the issue of the controversy; yet his general conception and treatment of a patent suit were broad and drawn on large lines. In some of the most intricate cases calling for special technical knowledge of electrical matters, he made himself by general and special studies so proficient that he was able to teach his own experts what they had previously failed to appreciate. The writer well remembers a remark made to him by Mr. George R. Blodgett, chief patent attorney for the General Electric Company, while the famous suits on the Tesla patents were pending, to the effect that Mr. Buckingham, who conducted the defense, had surprised them all by his technical understanding of the principles involved. Mr. Blodgett considered that Mr. Buckingham had made himself one pre-eminent expert in the Tesla art, which at that time was not so generally well understood as now; and that whoever wished to master the technicalities of that art could learn much by consulting him.

Nor was he less scrupulous in the detailed preparation of his cases from a legal standpoint than he was from a technical and scientific standpoint; and there can be no question that his methods were effective.

He was himself an inventor of recognized ability. The perforator and printer which he invented while patent counsel for the Western Union Telegraph Company and the American rights for which he sold to that company, are examples of his tireless work upon subjects which interested him, and they display inventive ability of a rare order. The perforator is in constant use by the Western Union Company, although the printer has, it is understood, been set aside. In the production of these two devices Mr. Buckingham spent years of time, endless labor and large sums of money in overseeing the development of practical working apparatus at the shops of the model makers, and his triumph in the end was due to the same kind of pertinacity and attention to details which marked all his other work.

As a writer he possessed lucidity and a power of condensed expression that would not be expected by one who was familiar only with his legal briefs. This was illustrated by his contribution, "The Telegraph of To-day," to a series, "Electricity in Daily Life," first published in *Scribner's Magazine,* and later in book form (1891). In this series Mr. Buckingham was associated with such scholarly and eminent teachers as President Morton of Stevens Institute and Professor Brackett of Princeton College.

In the death of Mr. Buckingham the world has lost a powerful personality, and the Patent Bar one of its most notable members. *G. H. S.*

It is not to be doubted that, in the close circle of those who, during the last 25 years, have been sufficiently familiar with Mr. Buckingham's work to appreciate the quality of its silent triumphs, a sentiment of deep regret prevails that, in a large measure, he had not attained the fame which would have been his had his field of labor been more within the popular eye. In fact, it is almost pathetic that the enormous energies which he expended and the intricate and far-reaching legal campaigns which he developed in the defense of suits vigorously prosecuted by high talent, on such issues as the validity of the fundamental patents on the arc-light regulator, the rheostat control of the electric car, the three-wire system, the Tesla motor, and the Hutin & Leblanc multiphase system, should have remained undisclosed even to the major part of his professional brethren.

The consolidation of the opposing interests in almost all of these causes brought about their settlement before they could be passed upon by the courts, and the colossal structures which had been built up with such tireless zeal were withheld from view. In these instances, the fruit of his labors was the advantage which his clients derived from the resulting mergers, and that they were fully appreciative was made manifest by their virtual monopoly of his services up to the time that he laid down the burden of his life's work.

That his victories were not all in the public forum does not lessen their importance, but to those who loved the great-hearted lawyer and were proud of his remarkable accomplishments, it will ever remain a disappointment that so much of his intellectual activity should have been veiled from those not immediately associated with him.

The foregoing notices speak in terms of temperate moderation of the public and professional activity of our friend. Of that inner life, illuminating his being, and which, from afar, as one saw him approach, warmed the heart, it is impossible to think without emotion. Peace to his kindly and generous shade! Green be his memory among us! *J. C. P.*

CURRENT NEWS AND NOTES.

TECHNICAL GRADUATES OF UNIVERSITY OF ILLINOIS.—At the recent commencement 26 of the 156 graduates of the College of Engineering of the University of Illinois received the degree of bachelor of science in electrical engineering. In addition the advanced degree of electrical engineer was conferred on six post-graduates.

TELEPHONE OPERATORS' SCHOOL.—A telephone operators' school is being installed in the Springfield, Mass., exchange, where operators will be trained not only for the Springfield exchange, but for those in Chicopee, Indian Orchard, Holyoke, Westfield, Northampton, and perhaps other exchanges. There will be a similar school at Worcester to provide for the Worcester district. Operators will be given a regular course of lectures, study and practice in telephone operation.

MALICIOUS CUTTING OF TELEPHONE CABLES.—Owing to recent losses of the Chicago Telephone Company from the malicious cutting of its cables, some of them underground, the police department of Chicago has issued an order directing that especial attention be paid to the protection of this property. In addition, the telephone company has offered a reward of $500 for the arrest and conviction of persons damaging the cables and thus interfering with the telephone service.

CONVENTION OF AUTOMOBILE ENGINEERS.—The annual meeting of the Society of Automobile Engineers, of which Mr. Alexander Churchward, of New York, is secretary, will be held in Chicago on Aug. 5, 6 and 7. One session of the convention will be devoted to the discussion of various problems connected with electric automobiles. Mr. F. J. Newman, of the Woods Motor Vehicle Company, Chicago, a member of the board of managers of the society, is chairman of the committee making the local arrangements.

STEEL VERSUS WOODEN CARS.—A member of the Indiana Railroad Commission who has made an investigation of the recent disastrous accident on the Chicago, Lake Shore & South Bend Interurban Railway, between Gary and Chesterton, Ind., draws a lesson of considerable significance from the wreck. He points out that one of the cars in the eastbound train was of an old type and constructed almost entirely of wood. All the loss of life was in this car. No one was injured seriously in the other eastbound car, which was partly of steel construction.

WIRELESS ATLANTIC SERVICE.—A committee of the Imperial Press Conference, recently in session in London, reported that Marconi had stated to the committee that by August he hopes to supply a press service for 15,000 words a day, at least, across the Atlantic at 5 cents per word; the present cable rate is 10 cents per word. Marconi also said that he believes it possible in the near future to communicate by wireless over a distance of 6000 miles or even more. The present speed of wireless messages across the Atlantic is, he said, 35 words a minute, but it is hoped soon to increase this to 50 words.

NEW ORDER IN NEW YORK METROPOLITAN RECEIVERSHIP.—Judge Lacombe, of the United States Circuit Court, has amended the original order for the administration of the Metropolitan Street Railway Company by the receivers. There has been considerable dissatisfaction expressed among those interested in the affairs of the company as to the manner in which certain accounts were kept, and for this reason the original directions of the court have been amended. Under the new rule the methods of the receivers in the matter of keeping the books of the corporation and of accounting for receipts and disbursements are expected to be greatly improved. The judge has instructed the receivers and all parties interested in the company to agree in writing upon the manner and form in which the books shall be kept, and the final order, when issued, will embrace this agreement.

NEW ARCO WIRELESS SYSTEM.—Count von Arco, inventor of the Telefunken system of wireless telegraphy, has announced a new system of wireless telegraphy which he calls "Tonende Funken" (sounding sparks). This system, it is stated, is covered by applications for about 70 patents. In the new system, which is based upon discoveries in physics made by Professor Wien, and published in 1906, it is said that definite spark sequences anywhere from 40 up to 200 per second can be maintained. It is claimed that through the use of "sounding sparks" the serious limitations which have previously existed in wireless telegraphy have been entirely overcome.

GEORGIA WATER POWERS.—Prof. S. W. McCallie, State geologist of Georgia, is the author of a pamphlet entitled "Inventory of the Water Powers of Georgia," which gives all of the available data relating to Georgia undeveloped water powers. Professor McCallie divides the State into the "Savannah basin," the "Altamahe basin," the "Ogeechee basin," the "Mobile basin," the "Apalachicola basin" and the "Tennessee basin." An appreciation of the work of Professor McCallie is implied in a request by Mr. Gifford Pinchot, chairman of the National Conservation Commission, for copies of the pamphlet for each State chairman of the Conservation Commission.

GOVERNMENT REPORT ON ALASKAN COPPER.—Messrs. F. H. Moffit and A. G. Maddern have prepared a report upon the Alaskan copper deposits which has just been issued by the United States Geological Survey as "Bulletin 374." The report is especially devoted to the Copper River-Chitina River region and includes an account of the geography and history of the region and of its general geology, as well as notes on the copper minerals and ores, the source and character of the deposits, and detailed descriptions of the various properties, and is accompanied by geologic and topographic maps, graphic geologic sections, and reproductions of photographs. It may be obtained upon application to the Survey.

NAVAL WIRELESS TELEPHONY.—As a result of representations made by the company which supplied the wireless telephone equipment to the battleship fleet prior to its cruise around the world, the Navy Department is making an investigation of the alleged facts upon which a report condemnatory of the wireless telephone equipment was based. Although this report condenmed the wireless telephone as useless, an officer on one of the ships has stated that by its means conversation could be maintained between ships 10 and 15 miles apart. The guarantee of the company which supplied the apparatus was limited to a radius of five miles, and it is claimed that the system was actually successful over this range.

BUFFALO MIDSUMMER EXPOSITION.—Buffalo's Midsummer exposition was opened on Monday, June 21, when Mayor Adam threw in the main switch which lighted the 9000 incandescent lamps used for lighting the grounds. Electrical energy is supplied to the transformer station on the grounds by the Buffalo General Electric Company from its overhead 2200-volt, three-phase, 25-cycle system. Seven 25-kw, oil-cooled transformers are used and all worked at an overload as they are in service only between three and three and one-half hours. The Buffalo General Electric Company has one man in attendance at the exposition. The exposition will probably be an annual affair and it is expected to grow in size and significance. One point not pleasing to the electrical man is the use in a number of the manufacturer's booths of gas arcs for illumination, besides a number at the main entrance to supplement the electrical equipment. The illumination arrangement as a whole has been subject to criticism.

INDIANA ELECTRIC LIGHT ASSOCIATION CONVENTION.—The Indiana Electric Light Association convention will be held at French Lick Springs Aug. 18 and 19, 1909. Mr. Fred Leslie, general manager of the Muncie Electric Light Company, is secretary and treasurer.

OUTING OF COMMONWEALTH EDISON BRANCH, N. E. L. A.—It is announced that the Commonwealth Edison branch in Chicago of the National Electric Light Association will give an outing or field day at some date in August to be fixed later, at which various games and athletic contests will be enjoyed. The arrangements are in charge of Mr. J. W. Ferguson, the assistant general contract agent of the company.

ELECTRIFICATION OF CHICAGO RAILROAD TERMINALS.—The Illinois Central is continuing its study of the electrification problem, and Mr. L. C. Fritch, the railroad company's electrification adviser, is making a further study of electrified lines in the vicinity of New York City. The company's delay in announcing a beginning of the electrification work is ascribed to the difficulty in rearranging its terminals for electrical operation.

DANGER TO BOYS IN TOUCHING ELECTRIC WIRES.—Mr. William Carroll, city electrician of Chicago, has written a letter to Mr. O. C. Schneider, president of the Board of Education of that city, suggesting that school children should be drilled in the danger of touching electric wires. So many accidents have been caused to mischievous boys by pranks of this description that Mr. Carroll believes that children should be taught to avoid wires of all kinds as they would venomous serpents.

THE CHEAPER KIND WOULD DO.—The *Edison Round Table,* published by the Commonwealth Edison branch of the National Electric Light Association in Chicago, tells the story of a woman customer in reduced circumstances who recently came in to pay her electric-light bill and at the same time made a timid request that was unusual. She said that she noticed that the bill was made out for 12 kw-hours at 14 cents and 8 kw-hours at 9 cents. "You know I don't do any entertaining to speak of," and added, "it would really be quite satisfactory if you would send only the 9-cent variety hereafter."

A BAD INTERURBAN ACCIDENT.—A head-on collision on June 19 between eastbound and westbound trains on the new Chicago, Lake Shore & South Bend Electric Railway, between Gary and Michigan City, Ind., resulted in the death of 10 persons and the injury of 28 others, of whom 3 may die. An official statement issued by Mr. H. U. Wallace, of Michigan City, general manager of the interurban line, states that the crew of the eastbound train was entirely to blame for the disaster. Orders were delivered to the men in control of that train to stop at a place known as Wilson siding, and if this had been done the accident would not have occurred. It seems to be established that the orders were delivered, and no explanation remains other than that the crew of the eastbound train simply forgot its order, not being accustomed to stop at this siding, and ran past the switch. The injuries were confined almost entirely to passengers on the eastbound train.

MUNICIPAL OWNERSHIP IN INDIANA.—At the nineteenth annual convention of the Indiana Municipal League, held at Lafayette, Ind., June 22 to 24, the subject of municipal ownership was discussed at length. While the majority of those who spoke expressed themselves in favor of municipal ownership, the delegate from the Logansport Council said his experience taught him that municipal operation was more successful when applied to water-works than to electric light plants. Mayor Becker, of Hammond, while advocating municipal ownership, referred to lack of management of public plants, and recommended the passage of a law requiring city engineers and managers of municipal plants to be technical graduates. Attempts to secure expressions of opinions from mayors who represented cities known to have unfortunate experience in municipal ownership were unsuccessful. Mr. Joseph T. McNary, of Logansport, was re-elected president of the league, and Mr. C. W. Merrill, of Richmond, continued as secretary.

ELECTRIC CLUB OF CHICAGO.—At the meeting of the Electric Club of Chicago on June 23 it was announced that by the courtesy of Mr. Stewart Spalding, of the Coliseum Garden, the members of the club had been invited to attend the concert and ballet at the Coliseum, on the evening of June 28, as the guests of the management. The invitation was accepted and a vote of thanks was extended to Mr. Spalding. From the house committee Mr. A. A. Gray reported that the prospects for making an arrangement to hold the meetings in the new Hotel La Salle were not flattering, but that negotiations were still in progress. Mr. J. J. Schayer, chairman of the entertainment committee, outlined the arrangements for a picnic to be held by the club on July 17 at Michigan City. The members of the club and their guests, including women and children, will leave for Michigan City by boat at 10 a. m. and return to Chicago about 10:30 p. m. An attractive schedule of games and athletic contests is being arranged. The principal speaker of the meeting was Mr. E. W. Lloyd, of the Commonwealth Edison Company, who gave a resumé of the proceedings of the recent Atlantic City convention of the National Electric Light Association.

THE N. E. L. A. CONVENTION IN RETROSPECT.—Two meetings were recently held in Chicago in which portions of the great mass of material presented at the recent Atlantic City convention of the National Electric Light Association were discussed. The first of these was that of the Commonwealth Edison branch of the N. E. L. A. on June 22, at which a written report was received from Mr. John C. Manley, one of the delegates elected to represent the Commonwealth branch at the convention. Mr. L. E. Marshall presided at the Chicago meeting in the absence of Chairman George H. Jones, and introduced Mr. Manley. The speaker gave summaries of a number of the Atlantic City papers. Taken as a whole, Mr. Manley was of the opinion that the papers presented were superior to those at any previous convention of the association, and he advised all members of the branch to read them carefully. The second meeting at which the convention was discussed was that of the Electric Club on June 23. The speaker was Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company, who touched on the "high spots" of the Atlantic City gathering. Mr. Lloyd said that the convention was one of the most notable in recent years, and he mentioned a few of its features. In referring to the three "power papers"—Mr. Lloyd on "Load Factors," Mr. Gille on "Electric Power" and Mr. Graves on "Group or Individual Drive"—he said these contributions were of great value in studying power conditions in order to build up the day load and improve load factors. The tendency must be toward improvement of load factors of central stations. It is true that the power load is on the peak to some extent, but the consumption of energy of industrial electric motors begins to decrease to a marked degree at 4:30 p. m.; between 4:30 p. m. and 5 p. m. perhaps 50 per cent of the peak is due to power load. The extended report of the committee on meters, headed by Mr. Geo. Ross Green, was referred to in terms of admiration. In the discussion of this report at the convention, as pointed out by the speaker, someone said that meters now cost the central station about $30 a kilowatt for connected load. This cost would seem to be too high, and it should be reduced. There is also a demand for maximum recording meters for polyphase circuits. Mr. Lloyd concluded by a reference to the report of the committee on public policy, calling particular attention to that part of the report having to do with the growth of pension systems for employees of manufacturing and operating companies. There seems to be a decided tendency toward the establishment of pension funds of this character by large companies.

Plant of the Greenville Light, Water & Ice Company, Greenville, Ky.

By JAMES S. KNOWLSON.

THE average city man scarcely expects to find the conveniences and comforts of urban existence in a rural community of perhaps 1800 souls, tucked away in a mining and agricultural district fully a mile and a half from a railroad. Such a community, however, is Greenville, Ky., situated in the middle western section of the State, a little off the line of the Illinois Central Railroad. The latest census report

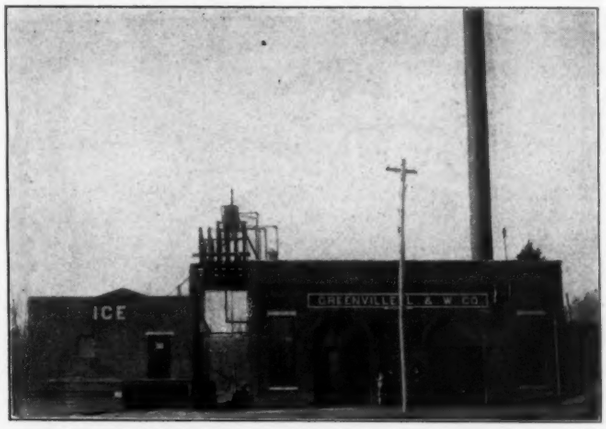


FIG. 1.—EXTERIOR VIEW OF THE GREENVILLE STATION.

gives the population as 1051. Optimistic local estimates place the figure as high as 2000, but 1800 is probably more than generous. At first glance it is a typical country town; but streets and houses are lighted by electricity, water mains run through the streets and artificial ice is made and delivered to customers.

A description of the Greenville Light, Water & Ice Company's plant, which serves this community, should prove interesting to all those who are concerned in the ways and means of supplying public utilities to the smaller communities, for two reasons: (1) The organization of the company seems to have solved successfully and satisfactorily the problem of municipal versus corporate ownership. (2) During the very first year of its existence, the gross revenue of the company has amounted to approximately $7.80 per capita and has been well in excess of the operating expenses.

Advocates of municipal ownership claim as the basic principle of their plan, that public utilities—being of direct and immediate concern to the people at large—should be owned and controlled by the people; that the success of the municipal plant is guaranteed because the interest of the community as a whole is centered in the enterprise, and further, that with a municipal plant, the consumer receives the commodity at the lowest price which will cover production costs. Those who do not believe in the practical success of municipal ownership hold, and their opinions seem to be borne out by facts, that "What is everybody's business is nobody's business"; that municipal plants are rarely under competent management or have a fixed and definite policy, and, that red tape and graft preclude economical operation. For this reason a corporate plant, under good and consistent management, can usually supply its commodity to the consumer at a lower price than the municipal plant, and at the same time net a just return to the investors.

There are two sides to every argument, but in the organization of the Greenville company a happy medium seems to have been reached. The authorized liabilities are: Capital stock, $40,000; bonds, $12,000, of which $37,000 of stock and $11,000 of bonds are outstanding. So far, all stock and bonds have been subscribed for locally, and paid for at par. The number of stockholders totals over 150, 90 of whom hold but one share of stock each, while $6,000 represents the share of the largest stockholder. The executive officers are the most prominent business and financial men in the community and the entire management of the plant is under Mr. J. H. Gilman, civil and mechanical engineer, to whom the plant owes its inception.

The wide and entirely local distribution of stock means that the plant is practically owned by the consumers and is almost as much of a public institution as a municipal plant. All profits made by the company return to the pockets of the consumers. At the same time, the company organization guarantees consistent, careful and businesslike management which completely removes the objections advanced to municipal ownership.

The plant was first put in operation on April 7, 1908, and today shows an investment of $51,000. This investment covers all property, apparatus and material necessary to the carrying out of its three-fold function of supplying water, electricity and ice to the town. The power-house building is a brick structure 58 ft. x 37 ft. x 19 ft., the same roof covering boiler- and engine-room. In the boiler-room are installed two 100 hp, return tubular boilers which supply steam for the whole plant. The coal pocket is located at the side of the boiler-room, and is built into the face of a small hill which simplifies dumping of fuel as wagons may drive direct over the trap opening.

Directly behind the power house is a water reservior covering 5.6 acres, with a capacity of 30,000,000 gal., held by a dam 25 ft. high, 300 ft. long, built of earth reinforced by concrete. The reservoir is enclosed by a high wire fence. The water system is a direct-pressure one and two compound duplex pumps, built by the Platt Iron Works, which force the water through a little over 11,000 ft. of 6-in., 4-in. and 1¼-in. pipe at a pressure great enough to throw a stream over the largest building. Water for houses and stores is paid for at a meter rate of 25 cents per 1000 gal., with a minimum charge of $1 a month. The city contracts for eight hydrants, and three additional hydrants have been installed for private consumers who desire additional fire protection.

The electrical equipment is entirely of General Electric Company manufacture and consists of one 105-kw, three-phase, 60-cycle, 2300-volt generator, direct connected to a 14-in. x 16-in. McEwen simple engine. The streets are lighted from a series alternating system and commercial lighting is fed from single-phase, 2300-volt circuits. About five miles of pole line has been erected and the distribution is constantly being extended. The city contract covers 21 acres which operate on an effective moonlight, all-night basis, and are paid for at the rate of $65 per year per lamp. Residence and business lighting is metered

FIG. 2.—WATER RESERVOIR OF GREENVILLE COMPANY.

and charged for at 12 cents per kw-hour for the former and 10 cents for the latter, with a minimum charge of $1.25 per month.

The equipment of the ice plant consists of a 15-ton absorption ice machine, built by the American Machine Company. The freezing tanks are installed in a brick and frame building, 56 ft. x 24 ft., located adjacent to the main power house. This building also contains a cold-storage room. Ice is retailed at rates ranging from 25 to 50 cents per 100 lb., depending on the

quantity taken. Ice has found a ready market not only in Greenville itself, but in the mines and smaller communities in the vicinity, and the cold-storage room has been greatly appreciated by the local meat dealers.

The first year is, of course, a hard one for a central station supplying electricity and water, for all houses must be wired and piped before service can be rendered, and this is a slow and as a general rule, a laborious task. The wide distribution of stock and the general interest of the community in the enterprise has been shown in the rapidly increasing number of meter connections, both for lamps and water. On Sept. 1, 1908, 95 electric meters and 55 water meters had been installed. On April 1, 1909, 140 electric meters and 90 water meters were in operation. At the end of the year, April 1, the balance sheet of the operating account shows the following:

REVENUE.		
Water	$1,120.67	
Electricity	4,037.87	
Ice and cold storage	5,094.91	
House wiring and supplies	3,896.11	
Total		$14,149.56
EXPENSE.		
Operating expense	$8,086.51	
House wiring and tools	3,974.26	
Total		12,060.77
Net revenue		$2,088.79

The construction and supply business has been carried at cost and in reality shows a small loss for the year. The net revenue, or the balance of profit is, of course, not very large, but when it is remembered that this is the first year of the company's existence, the amount is surprisingly good.

The operation of the plant is carried on by a standing force of four men. The manager, electrician, and two engineers, one night and one day man. In the spring and fall, one additional man is employed as an ice maker, and in midsummer the total force numbers six, an icemaker being employed on each shift. This force is exclusive of the ice delivery, which is this summer being delivered by the company's own wagon and team.

People of the town are extremely proud of their plant, not only because of the daily conveniences which it supplies, but on account of the adequate fire protection which they have never had prior to this time. About two months after the plant started a fire broke out in the principal business block. It was extinguished without much loss, but it is estimated that over $60,000 worth of damage would have been done if this fire had started before the adequate water supply was available. The Greenville Company is just starting on the second year of its existence, with an established business and an ever increasing load. It is safe to say that the revenue for this year will exceed the last by at least 25 per cent and at a better profit. Great credit is due Mr. Gilman for his competent management, and hundreds of other communities which, with equal resources, are without equal conveniences, might with advantage follow the example of this progressive town.

Small English Central Station.

By Charles Dawson.

Having been for a number of years in the United States and being conversant with American practice, the writer feels that possibly a description of the class of electric light and power stations to be found in small English towns will be of interest as showing wherein the practice of both countries differ. In English towns some of the stations are owned by the corporations of the towns and others by public or private companies. It should be borne in mind that in England there are severe government regulations which call for work of a certain high character. No overhead conductors are tolerated, and rules as to the size of conductors, insulation and methods of installing them must be complied with, so that a much larger outlay is required than for a similar size plant in the United States.

As a rule, in England there is but very little day service in small towns, so that it becomes necessary to install a storage battery, which also is used to carry the load after midnight, the arc lamps being usually extinguished at that time. The incandescent lamps at present employed have carbon filaments, but metallic-filament lamps are coming into use with very satisfactory results. As a typical example of a small English central station, that of the Urban Electric Supply Company, at Godalming, in the County of Surrey, and about 34 miles from London, may be cited. The station is situated in a very picturesque valley surrounded by wooded hills. The buildings are well built of red brick and contain, beside the power equipment, storerooms and offices. They are surrounded by a well-kept garden and, taken altogether, the surroundings are quite charming.

FIG. 1.—EXTERIOR OF POWER HOUSE.

The distribution mains and feeders are installed in a durable manner. No poles are used, greatly to the advantage of the town, and when cables have been placed underground the road has been carefully relaid and is none the worse for having been opened. Street connections and feeder connections are made in underground brick manholes with cement and iron covers. Godalming has a population of 10,000 and an area of 706 acres.

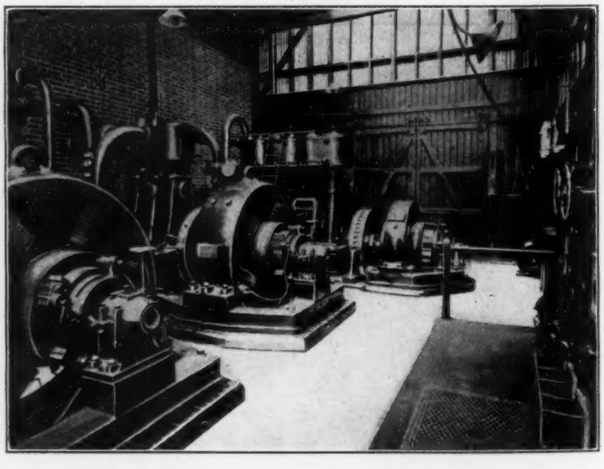


FIG. 2.—INTERIOR OF ENGINE-ROOM.

The power house was erected in July, 1902, and at the end of the year the connected lighting load was 180 kw and the output 63 kw. There was at the close of 1907 a connected load of 380 kw and an output of 250 kw; the full rating of the plant being 400 kw.

The equipment in the power house comprises three water-tube boilers supplying steam to as many high-speed Bellis en-

gines at a pressure of 150 lb. The boilers are fired by mechanical chain-grate stokers using soft coal and there is an absence of smoke from the stack at all times. On its way to the engines the steam is superheated 250 deg. Fahr. The engines are direct-coupled to the dynamos, which were built by Fowler & Company, and general direct current at a potential of 480 volts which is used on a three-wire system. One of the generators is rated at 200 kw and the two others are rated at 90 kw. A storage battery rated at 250 kw and having a maximum discharge rate of 80 amp is also in service. The average discharge during the daytime, from 9 a. m. to 6 p. m., is about 20 amp. During the day there is practically no load except 40 hp in motors in a manufacturing plant.

The engines operate condensing and the feed water, which contains much foreign matter in solution, is heated to about 200 deg. Fahr. before being fed to the boilers. As will be seen from the illustration of the engine-room, the equipment is well arranged and, being of the best, the capital outlay is much heavier than for a similar-size plant in America, although the price for energy is higher than obtains in the United States. The staff is also much larger than is required in a plant of this size in the States, but the wages paid are less. Under the management of the resident and service engineers, the upkeep is admirable. The life of all concerned is much easier than would be the case in the United States under similar conditions and the operating force seems to be contented with its lot. There is not much extra work as the boilers have to be cleaned only once a year, and the plant has been free from breakdowns of a serious nature.

The main feeders are single, vulcanized bitumen, three-cored armored cable laid in wood troughs with tile covers. Distributors run from feeder pillars and these in turn are subdivided in underground brick boxes. There are about three miles of feeders and approximately 15 miles of street wires. Ten series-arc lamps are used for lighting the streets and 230 50-cp and 25-cp incandescent lamps. The drop between the power house and the farthest point in the service is 18 volts. It might be mentioned that the Government rules require a conductor of such section that the rise in temperature caused by the current passing through it must not be over 35 deg. Fahr. The price charged for electricity is 12 cents, with a discount of 2½ per cent for payment within a month. If supplied through a prepayment meter the rate is 14 cents per kw-hour. The charge for the meters, which are the property of the company, is 50 cents and $1 per quarter according to size. Energy sold for motors is subject to a 5-cent rate and the 2½ per cent discount. The streets are lighted from one-half hour after sunset to midnight, there being no public lighting after that hour. Energy for house service is, however, available from the storage battery.

The working staff consists of one engineer, two firemen, three boys and from two to three line and service men, all of whom work 56 hours per week. The office staff consists of the chief engineer, one chief clerk and two junior clerks. The cost of fuel delivered into the bins is about $3.75 per ton and the coal is hand-fired into the hoppers of the stokers. The cost of fuel per kw-hour generated is 1.34 cents; oil, 0.08 cent; wages, 0.42 cent, and repairs, 0.42 cent, making a total of 2.26 cents. If all expenses, including salaries and upkeep, are taken into account the cost per kw-hour is 3.36 cents.

The prepayment meters have since been discontinued because they did not pay at the rates charged, which included wiring. This can be understood from the fact that the average consumption per house was only about 2 kw-hours per month. On the whole, the plant is a very good example of the kind where a private company holds the franchise for a small country town. It is remarkable that a profit can be made on a station operating for so few hours and with so small a day load, the latter being, in fact, too small to warrant the installation of batteries. The plant is but one of a number of small stations owned by the company. Up to Dec. 31, 1907, the total expense of the plant, including distribution and every outlay, was $277,904, while the revenue from all sources amounted to $25,027. The sum of $11,447 was applied to dividends for the year 1907. This shows about a 5 per cent dividend on the investment, and as it includes new work on the capital account and as the sale of energy is only about 62 per cent of the maximum output, it would seem that a higher dividend might be looked for when the plant is fully loaded. An item of expense which might strike an American as heavy for an urban plant is the sum paid for rates and taxes, which amounts to $629.

Central-Station at Mount Carmel, Ill.

The plant of the Mount Carmel Gas & Electric Company, of Mount Carmel, Ill., is a good example of a property which has been brought up within a few years from a very much underdeveloped condition to one of the best organized systems in a town of its size in the State. The development which has taken

FIG. 1.—ENGINE-ROOM, MOUNT CARMEL.

place in the past seven years has been largely the result of the efforts of Mr. A. R. Manley, the present manager of the company. It has been entirely the result of a management sufficiently effective to make it possible to borrow money from time to time to enlarge the property. Unlike many other systems, at the time Mr. Manley took hold, the company had no particular financial backing and its credit was de-

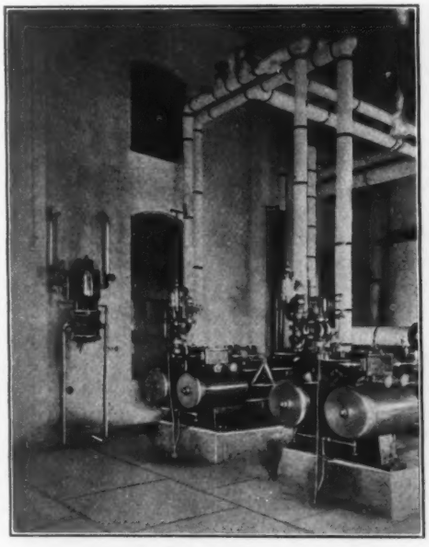


FIG. 2.—HEATING SYSTEM PUMPS.

pendent entirely on the financial showing made from operation as a result of good management.

Previous to January, 1902, the town of Mount Carmel, which had in 1900 a population of 4311, depended for its electric light service on an organization known as the Mount Carmel Light & Water Company, which operated a water-works system and at the same plant had one 40-kw, 133-cycle National alternator

and one 40-light Wood arc machine with 33 arcs. There were about 600 incandescent lamps connected. From this it will be seen that the central-station business in Mount Carmel was very much underdeveloped. In January, 1902, a new generating station was started and two 90-kw, 60-cycle, 2300-volt units in-

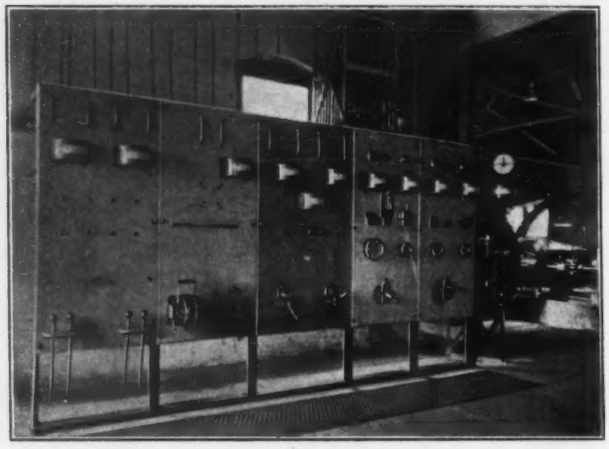


FIG. 3.—SWITCHBOARD.

stalled. Before the plant was completed one of these units was displaced by a 150-kw set. The plant now has two 150-kw, two-phase Bullock alternators, shown in Fig. 1, and is about to add a 300-kw, direct-connected unit. The boiler equipment consists of one 300-hp Stirling boiler and two 150-hp Stirling boilers, making a total of 600 rated hp. The engine equipment consists of one Lane & Bodley Corliss running at 95 r.p.m. and belted through a lineshaft to a 150-kw alternator, and a Russel medium-speed engine direct-belted to a 150-kw alternator.

In connection with this plant there is operated a hot-water heating system designed by Mr. W. H. Schott. About 40,000 sq. ft. of radiation is connected to this system. The mains have a capacity of 100,000 sq. ft. Heating service is given from Sept. 15 to May 15 each year. The day load, which is from 60 kw to 100 kw, is such that exhaust steam can be used almost entirely for this heating and very little live steam has to be used. This heating plant was started in 1907. The pumps for the heating system, shown in Fig. 2, consist of two circulating pumps and one condensation pump.

The two generating units now in the power plant have operated for the past five years without a single shut-down due to an accident. The station operating force consists of three engineers and four firemen, working eight-hour shifts. One of these firemen also attends to the water-pumping station. In one end of the boiler-room is a well-equipped machine shop. Fig. 3 shows the switchboard, which contains two generator, two feeder and one series-arc panel.

At the time the plant was moved from the water-works to a location alongside the Southern Railway more favorable for receiving coal, electric pumping was inaugurated at the water-works plant. Water is pumped directly from the Wabash River to a standpipe on the river bluff. There are two triplex pumps, made by Deane, of Holyoke, running at 50 r.p.m. One is driven by a 35-hp Wagner single-phase motor and the other by a 30-hp motor of the same type. These pumps work against 80-lb. pressure. Two steam pumps and one 50-hp boiler are still kept at the water-works plant as a reserve.

The following facts and figures regarding the company's business indicate the state of development: The present population of Mount Carmel is estimated at 8500. The number of electricity consumers is 817; there are 13,000 lamp sockets connected. One hundred and seventy-nine hp in motors of 3-hp rating and over is connected. The fan load comprises about 300 desk fans and 100 ceiling fans. About 350 electric irons are in use. The refrigerating business is represented by one 20-hp motor in a meat-packing plant. There are 40 steam-heat customers aggregating 40,000 sq. ft. of radiation. The electric sign business has been well worked for a small town, as there are 11 such signs. There are also some illuminated signs placed on blank sides of buildings lighted by means of incandescent lamps covered with half shades. The company does an electric wiring and supply business, the gross revenue from

Mt. Carmel Gas & Electric Co.

Job No. ..... Dept. ..... Date .....

Name .....

DAILY TIME SLIP

Foreman	hrs. at		
Helper	hrs. at		
Helper	hrs. at		
Helper	hrs. at		
Work installed			

.....Foreman

FIG. 4.—TIME SLIP.

which amounts to about $20,000 per annum. About three men are kept busy on interior wiring.

A gas plant has recently been erected, but has not been in service long enough to be an important factor in the business. The water system, although owned by a separate corporation, is operated by the same force as the Mount Carmel Gas & Electric Company. With the electric light, steam heat, water and gas business to take care of, a much larger and more specialized organization is possible than would be for the electric lighting business alone. The organization is an unusually

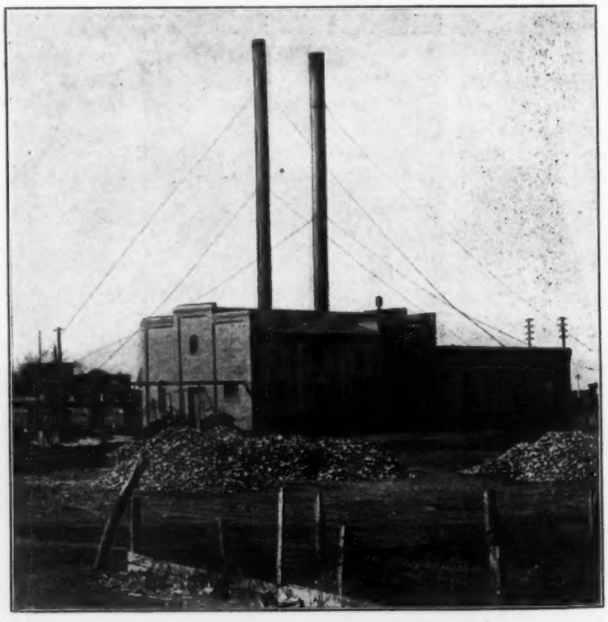


FIG. 5.—EXTERIOR VIEW OF STATION.

perfect one for a small company. The head of each department is held responsible for the men under him and for the results obtained in his department. The organization of departments is as follows: One man is in charge of meters and inside wiring, and he does the testing of meters himself. Another man,

who is called the general foreman, has charge of the waterworks system and the electric line work. The assistant superintendent has charge of the gas department, including construction and operation. The chief bookkeeper has entire charge of the office and records. Collecting and timekeeping is in charge of one man. A storekeeper is maintained, who is responsible for all supplies in stock. As the system of records worked out

Workman No..... Name.....
Pay Roll No.....
$..... .....19....
Received of Mt. Carmel Gas and Electric Co. Mt. Carmel
the sum of.....Dollars.....Cents.
for.....being in full to.....19....
Job.....
Correct.....Timekeeper.
Signed.....
Approved.....Supt.

FIG. 6.—WORKMAN'S RECEIPT.

by this company is unusually complete, some detailed description of it will be given.

Meters are read the twenty-sixth of the month. It takes four men to read the gas and electric meters, each man reading about 200 meters in nine hours. From the meter reader's book, entry is made direct to a loose-leaf duplicate invoice or bill book. Three of these bills are placed on a page separated by perforations. When the billing has been completed the bills are torn out and mailed, leaving the duplicates, from which the ledger is posted, The carbon duplicates of the bills are in the same order as the meter reader's books, which are arranged by routes. The ledgers are also arranged by routes so that the ledgers are easily posted direct from the duplicate bill sheets. By keeping duplicate bills it is possible to mail consumers' bills as soon as the bills are made out without waiting to post the ledger. They can then be posted to the ledger at leisure and consumers' accounts are collected several days sooner than would otherwise be possible. The gas, electric, water and heat invoices are distinguished by

Mt. Carmel, Ill., 190
DEPOSIT NO.
Mt. Carmel Gas and Electric Company

DISTRIBUTION OF ACCOUNTS	AMOUNT
Accts. Rec. Electric, Consumers	
" " Water, "	
" " Heating, "	
" " Gas, "	
Accts. Rec. Electric, Mdse	
" " Water, "	
" " Heating, "	
" " Gas, "	
Cash Sales, Electric, Mdse (Detail)	
" " Water, "	
" " Heating, "	
" " Gas, "	
Other Receipts (Detail)	
Total, $	

Approved..... Supt.
We credit your Acct. with $
DEPOSITED THIS DATE
AMERICAN NATIONAL BANK
Teller

FIG. 7.—DEPOSIT SLIP.

four different colors. This also applies to work orders for the different departments.

On electric wiring contract jobs a triplicate record is kept. The cost of time and material is kept on all contract jobs. A complete record of each job is kept together by keeping the slips relating to time and material in one envelope. The daily time slip is reproduced herewith, Fig. 4. The former work order is also shown, which has the list of materials on the reverse side. This, however, is about to be changed so that a duplicate will be kept on this also. Workmen sign receipts of the form shown in Fig. 6, when paid.

Petty cash is paid out upon a receipt blank properly filled out. All money received is deposited in the bank with a statement as to the distribution of accounts to which it is credited on the company's boooks. One of these deposit cards is shown in Fig. 7. The prime reason for this method of handling is that the auditor of the company is in another city and these deposit cards can be mailed to him as a continuous record of deposit.

The tungsten lamp has been extensively installed all through the business district; in fact, arc lamps have been practically replaced with them. The rates for power and lighting are: 8 cents for first 50 kw-hours per month; 7 cents for the second 50 kw-hours; 6 cents for the next 100 kw-hours, and 5 cents for all over 300 kw-hours. The minimum bill on lamp circuits is $1 per consumer, and on motor circuits 1 per horse-power. A deposit of $3 or a guarantee from some property owner is required before running a service because of the transient nature of the population.

Electric Light and Power at Montreal.

BY WILLIAM H. STUART.

The electric light and power business in the city of Montreal, Canada, is conducted by the Montreal Heat, Light & Power Company. This company was formed in 1901, absorbing the following minor companies: Royal Electric Company, Lachine Rapids Hydraulic & Land Company, Ltd., Montreal Gas Company, Standard Light & Power Company, the Montreal & St. Lawrence Light & Power Company, the Imperial Electric Light Company, the Citizens' Light & Power Company, Ltd., and the Temple Electric Company. Up to the fall of 1907 the company was handicapped considerably for lack of space and proper office accommodations. The company has since erected a commodious office building at the corner of Craig and St. Urbain streets, opposite the Street Railway Chambers. Its new home has been appropriately called the Power Building and is located in the business center of the city, close to the Post Office and the leading banks, where every convenience for the speedy transaction of business is assured.

In the basement are the vaults and storage-room. Space is also provided for substation equipment. As this portion of the building is very deep and it is not wholly used, the company conceived the idea of utilizing part of it for sign and large motor displays. Signs of every description are hung close to the ceiling in rows of three and four, and are controlled from a panel box provided with switches for throwing each sign into circuit separately.

On the main floor is the contract department, the office of the chief agent, a display-room containing over 1000 sq. ft. of exhibition space, and the bookkeeping and accounting departments. On the second floor are located the offices of the construction and operating departments; on the third are the executive offices, the board-room, the offices of the president, vice-president, secretary, treasurer, and of the auditing and legal departments. The fourth, fifth and sixth floors are rented and the seventh and top floors contains a convention hall and lunchroom for employees.

The salesroom is one of the show places of the building. The room faces Craig Street and has three large show windows, in which are generally placed electric lighting apparatus. From the main entrance through to the cashier's window, the display space is railed off by a large polished-brass railing. In this space are exhibited a great many gas and electric appliances, placed so as to be easily and practically demonstrated. The company's idea in maintaining this exhibition is to get on consignment appliances from various manufacturers and to act as their sales agent. Each of the appliances has a tag attached to it giving its consumption, cost of operation, first cost, etc. On small tables is placed the descriptive literature. All placards are printed in French and English. The entire

display is in charge of a salesman and a lady assistant, whose duty is to explain the various appliances to any one evincing interest. All orders for either service or appliances are noted by the salesman and turned over to the contract department.

The company has always had a contract department, but the work was not systematized in any way until 1906, when the department was reorganized and started afresh under the supervision of Mr. J. J. Cagney as chief agent. A card system was adopted and on these was placed a note of every house number in the city. The cards were first made up from the gas and electric meter-record books, and given the solicitors who went out and secured information on the lighting and power conditions. The cards are filed away and are kept posted up to date. Every year a place will be visited and the conditions noted upon the cards, which are looked upon as a valuable asset in the new business work. The city is divided up into five districts, to each of which a solicitor is allotted. Each man covers his district every day and reports on call cards the information which is transferred to large index cards. One man looks after the sign business, and the company also employs a special power man. In this end of the new business department it has been the policy of the company to co-operate with the large manufacturing companies, who notify the company of power prospects, and the company sends a list to the different motor or appliance houses so that they may all have an equal chance to effect a sale. In this way the field is very thoroughly covered by more than one man looking for business.

The company has never advertised on a large scale, but has at certain times featured some side of the business, such as sign work or window lighting. The advertising matter that is sent by the manufacturing companies is used a great deal, especially in the display department.

In the matter of signs the company furnishes a panel sign of 24 4-cp lamps at the rate of $2 per week on a flat rate. There are no signs on a meter basis. The charge of $2 per week includes everything. The signs burn from 6 to 12 o'clock every night, and are turned on and off by men in the company's employ. There is a penalty clause inserted in the sign contract to the effect that a consumer will be obliged to pay a fine of $10 if the sign is found burning when it should not. The sign is removed entirely if the consumer repeatedly violates the contract, and while the company generally allows a first offence to pass over, on the second the consumer is forced to pay the fine.

The growth of Montreal can be attributed in a large part to the utilization of electric power. Montreal, it is claimed, consumes more electrical energy per capita than any other city in the world. Twenty cities and towns surrounding the city are also lighted by the company. The price of electric lighting service in 1884 was $11 per 16-cp lamp per year. This has been reduced to a basic meter rate of 15 cents per kw-hour, subject to varying discounts, depending upon consumption, under which the cost of burning a 16-cp lamp during ordinary lighting hours does not exceed $3 per year. In 1894 the Royal Electric Company was supplying the equivalent of 14,700 16-cp lamps and 50 hp in motors. Its total number of consumers did not exceed 300, and none of the various heating appliances was heard of. At the present day the Montreal Heat, Light & Power Company has connected to its system the equivalent of 600,000 16-cp lamps, about 40,000 hp in motors and upward of 1200 appliances for heating, cooking, refrigerating, etc. The company serves upward of 20,000 electric consumers and about 55,000 gas consumers, or a total of 75,000 consumers. From May 1 to Oct. 31, 1908, there was a gain of 17 1/3 per cent as compared with the same period of the previous year. The increase in motors connected for the same period was 262 per cent. There was no increase in the amount of salary paid in the contract department, the business being obtained by introducing system into the work.

The lighting rates of the company were revised and reduced early last year. The old rates were 15 cents per kw-hour, less 5 per cent on one-year contracts, and 15 cents, less 15 per cent on five-year contracts. The new rates take into account residential and commercial service. The residential service rates are based on a one-year and a five-year contract. The one-year contract calls for a charge of 15 cents with a discount of 10 per cent on all energy consumed during the first 30 hours' use per month, per lamp installed, known as primary usage. On all energy consumed in excess of 30 hours' use per month, per lamp installed as above, known as secondary usage, there is a discount of 50 per cent. On the five-year contracts all energy consumed during the first 30 hours' use per month, per lamp of installation, known as primary usage, is charged for at 15 cents per kw-hour, with a discount of 20 per cent, and on all energy consumed in excess of 30 hours' use per month, per lamp installed as above, known as secondary usage, there is a discount of 60 per cent.

The commercial service rates are based on one-year and five-year contracts. On the one-year contract all energy consumed during the first 60 hours' use per month, per lamp of installation, known as primary usage, is charged for at 15 cents per kw-hour, less 10 per cent. On all energy consumed in excess of 60 hours' use per month, per lamp installed as above, known as secondary usage, there is a discount of 50 per cent. On the five-year contracts all energy consumed during the first 60 hours' use per month, per lamp of installation, is charged for at 15 cents, with a discount of 20 per cent. On all energy consumed in excess of this amount there is a discount of 60 per cent.

The company's motor rates are of particular interest in view of the success which has been attained in the broadening of the load curve. Non-peak power users are encouraged by a special concession, as will be seen by the following brief discussion of the rates at present in force. The power services are classified as follows: Unlimited day service, 10 hours straight, 7 a. m. to 6 p. m.; unlimited day and night service, 24 hours continuous; limited day service (off peak) from 7 a. m. to 6 p. m. throughout the year except from 4 to 6 p. m. between Sept. 15 and March 15; limited day and night service (off peak) 24 hours per day throughout the year except between 4 and 7 p. m between Sept. 15 and March 15.

On the limited day service the reductions given by the company amount to 25 per cent of the unlimited day rate. The same ratio of difference applies to the unlimited day and night service and the limited or off-peak day and night service. Three systems of charging are in vogue: A straight flat rate per hp-year, varying according to the average maximum load as determined by test; a readiness-to-serve charge based on the average maximum demand, plus a meter charge per hp-hour or kw-hour, also varying according to demand, and a straight meter rate per kw-hour or hp-hour as the customer chooses, likewise varying according to demand. The power meter rate is $0.02 per hp-hour, plus a minimum charge. The minimum charge is $3 per horse-power up to 5 hp; from 5 hp to 10 hp the rate is $2.50. A test is made of the motor load and the minimum charge is based on the test. For instance, a 1-hp motor which is only operated at 75 per cent of its rating is assessed $2.25 per month. A 5-hp motor at full load would have an assessment of $15 per month, plus energy consumed at $0.02 per hp-hour. The minimum power factor of motors when operating the consumer's maximum load is required to be as follows: Motors not exceeding 5 hp, at least 75 per cent; motors over 5 hp and not over 10 hp, 80 per cent; motors over 10 hp, 85 per cent. The flat rate is based on $55 per horse-power per year at full load, 24 hours per day service. A charge for a 10-hp motor under these conditions per year would be $550. This rate is reduced 25 per cent if the motor is not used during peak load.

The result of encouraging the non-peak business is very apparent. Starting in at 5 a. m. the curve gradually rises and reaches its highest point at about 8:30 p. m. From 12 to 1 p. m. the load drops considerably and starts again at 1 p. m. at about where it was at noon. About 3 p. m. the curve reaches its highest point and from there runs down until at 6 p. m. it drops again. From 7 to 9 p. m. it again goes up and then gradually through the rest of the night runs down to its lowest

point. The company has found that about 40 per cent of its customers can switch the motors out of circuit at the time of peak without detriment. Among the various customers are cotton mills, with 3500 hp, which start at 7 a. m. instead of 8 and which allow a half hour for lunch, stopping work at 4:30 p. m. The workers in the mills in many instances prefer to follow these hours and go home early than begin later and finish later. Among the off-peak consumers are the various morning and afternoon papers, to whom the company supplies over 400 hp. Brickyards require entirely a summer service and get about 50 per cent of the regular rates on seven months operation. The equipment amounts to about 700 hp, the motors being used to drive casting machines, mixers and conveyors. Other non-peak consumers are the local water company, which requires 1200 hp for pumping drinking water. Then there is 6000 hp which is used by a cement concern. These non-peak rates are as yet only given to trustworthy customers consuming relatively large amounts of power. An installation of 20 hp or 25 hp is the limit below which the non-peak rate is not as yet granted. Separate circuits are not run and time switches have not as yet been used to any extent, although the latter is being considered by the company.

The company controls practically all the developable and commercially practicable water-power within transmission distance of Montreal. The present plants include a 12,000 hp station at Lachine Rapids, a 22,500 hp plant at Chambly on the Richelieu River, the selling rights in Montreal of the large Shawinigan plant and 10,000 hp in steam plants on Queen Street and elsewhere in Montreal. There has been recently added a 2000 hp steam turbine to the steam plant at the Queen Street station. The company has a new plant on the Soulanges Canal, about 38 miles from the city.

Conditions Encountered by Towers in High-Tension Transmission Lines.

BY N. J. NEALL.

THE very characteristic of native receptivity and adaptability which rendered so successful the early introduction of high-potential transmission in this country and enabled America to surpass Europe in this respect for some time, likewise imposed upon the practice certain features, such as the wood-pole line, which, as concerns engineering completeness, can be regarded as far below the power house and substation which it connects. By a natural selection of materials long since made familiar by the telegraph practice of this country and with hardly no recognition of the limitations soon to be imposed by the rapidly diminishing forests, wood poles have continued in use for electric lines of all classes, the only difference among them consists in the requisite degree of insulation for the service and the increased size of poles and cross-arms as the voltages to be carried increased in value.

In the early days of high-voltage transmission the potentials generated and the distance to which energy could be economically carried were, in general, not very great; in fact, today the grand divisions of commercial voltages practically indicate closely the steps by which the art advanced. Of course, in this, as in all things, there were exceptions at the outset. For example, Messrs. L. L. and P. N. Nunn erected and put in successful operation near Salt Lake City, Utah, a 40,000-volt line long before the general practice in the art reached so high a potential.

It is needless to dwell further on the backwardness of pole-line construction save to point out that the initial use of wood-pole lines was an economic necessity and in this respect provided a solution as to the feasibility in cost of energy transmission that might otherwise have been prohibitive. As time has gone on and new projects of a similar character have been developed the question of line supports has become more and more serious. The problem itself is very simple. It is this: In view of the decreasing lumber supply and consequent increased cost of selected large poles can any given long-distance electrical transmission line project find some other form of support as a satisfactory substitute? It seems almost useless to ask such a question when the answer in the form of metal-tower construction, reinforced-concrete poles, etc., is now so well known.

The first towers for modern electrical transmission purposes noted officially in American engineering literature were descriptions of European practice.[1] It is curious to observe how different are these from our own in many respects. In the first place, the arrangement of insulators and circuits in the vertical plane as contrasted with our standard triangular arrangement is very marked. Again, the latticed tower is one not generally used in this country, outside of special city work and steam-railroad electrifications—except where the available space is limited. In fact, it may be put down as strictly typical of American practice to evolve a type for its own purposes; the most natural for this use was the familiar light-weight steel windmill tower. In this way one was at once enabled to secure a form of suspension which not only permitted longer spans, less total insulators, etc., but applicability in places where ordinary pole construction might be unduly expensive, if not prohibitive. The first installation of this character, which was in Mexico, has been described by Mr. Norman Rowe.[2] This innovation in long-distance transmission subsequently received considerable attention from the American Institute of Electrical Engineers under the auspices of the High-Tension Committee beginning in 1902, and at the International Electrical Congress, St. Louis, 1904, and since then the use of this device, the number of manufacturers and variety of types available have become greatly extended.

The engineer can to-day use several forms for his purposes. These are Class 1: Standard metal wind-mill work; standard structural steel for latticed and other tower forms. Class 2: Reinforced-concrete poles.

The limitations of the various forms of support listed in the preceding paragraphs are best brought out by an analysis of the service requirements, as follows:

Voltage.—The voltage is a fundamental element and governs the spacing between the conductors and the safe distance between the live parts and ground. The average spacing between wires for 60,000-volt service is from 6 ft. to 7 ft. The usual minimum safe working distance between live part and ground at all parts save the insulators is approximately ½ in. for every 1000 volts; thus for a 60,000-volt service a 30-in. clearance, if possible, should be maintained. It is obvious from this fact that the general over-all dimensions are governed by the voltage rating so that with the primary requirement of a clearance above ground for the lowest point of a space of from 18 ft. to 22 ft., the total height of the tower becomes, in turn, dependent on the allowable sag and the length of the span to be employed.

Span.—The maximum permissible span is solely a matter of adjustment among several quantities, including the power factor and frequency to be used in transmission, which for given voltage determine the size of the wire and the maximum safe strain to which the material selected for a conductor may be subjected, and the most economical span and corresponding tower cost, respectively, involved by the given conditions of voltage, load and methods of operation.[3] Since for a uniform strain the sag of any given span varies directly as the square of the length of the span, the final height of a support is determined accordingly.

Loads.—The preceding primary conditions affect only the

[1] *Transactions A. I. E. E.*, 1904, Vol. XXIII, Page 147.
[2] *Proceedings A. I. E. E.*, 1907, Vol. XXVI, Part II, Page 1239.
[3] *Transactions A. I. E. E.*, 1907, Vol. XXI, Part II, Page 1233.

Inasmuch as it is solely the purpose here to indicate the general procedure in tower selection for which the electrical engineer is primarily responsible, no analysis of the tower size and form in relation to the most economical span will be made. It must be remembered, however, that the tower finally selected should be the result of a reciprocal adjustment between the requirements of the electrical engineer on the one hand and the structural possibilities at the command of the tower builder on the other. The design of transmission towers is a field by itself and with its details the electrical engineer has only a broad concern.

dimensions of the support; the strength and size of its members depend entirely on the loads which the service imposes. These loads are as follows:

Dead weight of conductors and other span strains. Additional extraordinary weight of sleet, which in some localities may be taken as ½-in. layer of ice, or a total increase of 1 in. in the effective diameter of the conductor; this is a variable quantity dependent on known local meteorological conditions; in some parts of the world it may be neglected. Wind strains on conductors and tower in a direction perpendicular to the length of the circuit.

Special.—In addition to the preceding requirements for line supports on a level right-of-way, special conditions, such as river crossings, angles, cross-overs, line-sections, railroad and foreign wire crossings, etc., by reason either of extraordinary span characteristics or high safety against failure call for supports of special form and strength. These structures differ merely in degree from the fundamental form discussed and need no further consideration here.

Anchors.—Having once determined these general characteristics of the supports above ground, it is necessary to decide upon a form of anchorage sufficient to keep them erect in service. It is clear that the best tower possible may fail utterly if not properly anchored. This condition covers the nature of the soil involved as much as the anchor pieces themselves.

The anchorage of the tower for ordinary soil may be said to consist usually of two parts: the extension of the tower proper —the so-called legs—and the means employed to weight the legs. One style of anchor for this purpose consists of a piece of comparatively heavy angle iron from 6 ft. to 7 ft. in length—to which the tower is later bolted—flattened at one end to hold rigidly another piece of angle iron fastened cross-wise to it. The latter when in place is at the bottom of the hole. The proportions and depth are merely dependent upon the load above ground. For weighting various measures are taken; in general the following may be employed: Concrete; cast-iron molded on the leg at the lowest point; special structural beams laid under ground; special arrangement of wood ties and rods, etc.; carefully tamped earth—that is, zero weighting in the sense of this paragraph.

If the earth in which a tower is located is of sand and loam or gravel, or mixtures of these closely packed and firm, there will result a surprising strength against pull out from the mere resistance of the earth alone. Theoretically, the resisting force depends on the weight of the anchor piece plus that of the entire prism of earth extending at an angle of approximately 30 deg. with the vertical from the bottom of the anchor piece[1] and can be considered as effective in estimating the moments of the tower about the base at any given point as a fulcrum. As a matter of fact, tests that have been made show the strength to be apparently much greater, due perhaps, to the resistance of such a mass against shearing from its surroundings. Furthermore, in the case of towers having a square base, or a broad rectangular one, the mutual support against overturning by the various pairs of anchors involved, may greatly assist in this respect. Naturally the character of the soil has an important bearing on the matter. In the erection of a transmission line across dry country the mere omission of concrete at anchors, by reason of the decrease in cost, may make a critical difference in the possibility of their adoption.

The second element in anchoring a tower which affects its costs and suitability is the requirement whether it shall be a support having dead-end strength; that is to say, to stand up against the worst possible strains, due to failures of conductors or to predetermined maximum wind velocities; or to be merely a line support without such staying qualities under great stresses.

It is clear that between these two extremes a great variety of arrangement is possible. For example, for the major part of the line light weight towers with just sufficient strength to prevent being blown over may be used—guys being employed at given intervals to give the effect of anchor towers against destructive mechanical surges in the event of a line failure. Again, a mixture of dead-end towers and the lighter weight towers may be employed. At best, but of course at greatest expense, the dead-end tower may be used throughout. These are only a few of the arrangements followed; they may be said to depend entirely upon conditions of the right-of-way and on local requirements of safety and stability. The necessary strength of a support may then be said to be governed by conductor strains, dead weight and wind pressure; and of these, under normal conditions, the wind pressure is considered the most serious.

Insulators.—Owing to the recent introduction of suspension type of insulators and of their particular utilization for voltages much in excess of the present highest general practice—that is to say, for all potentials over 60,000 volts—tower dimensions, shapes and strengths are accordingly much modified from those designed to support the pin type of insulator. The general problem involved, however, is not affected except in detail.

Tower Materials.—Standard structural-steel parts, such as angles, channels, pipes, rods, etc., of the lightest available and feasible weights form the basis of metal tower construction. It is in their combinations, however, that the variations in manufacture and practice arise. The general form of tower is a rectangular prism, each side of the prism being made up of panels consisting of angle irons, channels or similar material, braced diagonally by some form of tension rod. The apex of the tower is usually the distinctive feature, since it is here that arrangements are made for supporting the line wires. Some towers in the form of triangular prisms have been installed, but they are comparatively few.

Following up wind-mill practice the greatest number of towers now in use are given a galvanized finish. Some towers, however, are painted in the usual way. There is some discussion as to the lasting quality of galvanizing, but inasmuch as this is usually put on after all machining is completed, there is little invitation to form rust save in the bolt threads and even these are given a galvanized finish by some manufacturers. There seems little reason to suppose that galvanizing will not be reasonably durable. A ready means of comparison on this point can be supplied by metal wind-mill towers which have been in use a considerable number of years. Some of the tower manufacturers have extensive galvanizing plants and the cost of this treatment needs scarcely any further consideration here. Care in inspection is a prime requisite.

Ease of Erection.—A necessary condition in tower design is compactness for shipment and ease for assembling and erection. These requirements are met by care in design and the use of bolts and nuts for assembling. For example, all parts of the tower are carefully marked with a significant letter chosen by the manufacturer to correspond with the diagram of the tower used by the field foreman. Bolts and nuts of the requisite quantity per tower may be packed in bags or boxes. All other tower parts are bundled in unit lots. By shipping such parts in car-load lots a minimum of freight expense and maximum ease of local distribution may be obtained.

In a typical case of this kind the anchorages are sent into the field and installed considerably ahead of the towers to secure as much as possible a restoration of the earth fill—if such be used—to the same compactness as its surroundings. These anchorages project sufficiently above ground to furnish later a fulcrum for placing the tower.

GENERAL PROBLEM.

In order to give some idea of the work involved in such a proposition consider the following typical case:

Energy at the rate of 10,000 kw, three-phase, 60 cycles, at 80 per cent power factor, is to be transmitted 70 miles over fairly rolling country, including a range of hills rising to a maximum of 2000 ft. above the surrounding country for about 10 miles and across a navigable river 1000 ft. wide with a total voltage drop not to exceed 10 per cent of the voltage delivered.

A preliminary analysis of the problem would indicate that the best e.m.f. for delivery will probably be in the neighbor-

[1] *Transactions A. I. E. E.*, 1907, Vol. XXVI, Part II, Page 1233. Trautwine On the Theory of Retaining Walls.

hood of 60,000 volts; that two circuits are required both to keep within the limit set for maximum voltage drop and to secure greater continuity of service in case one of the circuits should at any time be interrupted.

Before going further, certain electrical calculations must be made to fix the voltage and to determine the size of conductor. On a basis of 60,000 volts delivered, a spacing of 7 ft. may be selected for the conductors. This length insures against the dielectric losses discussed by Scott, Ryan and Mershon and is conservative from the standpoint of the arcing-over clearance required by the possible intrusion, from time to time, of large birds. The proper size of wire for the requirements is found tentatively by calculation to be a No. 2-0 B. & S. copper cable or a wire of an equivalent conductivity.

The following calculations are made on the basis of one-half the nominal power transmitted on a single-phase circuit of identical spacing of conductors, etc., as for three-phase; the resulting percentage losses are correct for either case—the actual energy losses for the three-phase circuit are just twice the values calculated for the single-phase circuit at half power:

Constants.

1. Resistance. R at 68 deg. Fahr. $= 0.822$ ohm per loop-mile.
   Total $R = 57.5$ ohms for 70 miles.
2. Inductive ohms $2\pi 60 L = 1.51$ ohms per loop-mile.
   Total inductive ohms $= 106$.
3. Capacity susceptance $= 0.00000282$ mhos per mile.
   Total susceptance $= 0.000197$.

Volts at generator end of line $= 65200$

$$\text{Voltage drop} = \frac{5200}{6000} = 8.67 \text{ per cent.}$$

Load and power factor at generator end of line $= 5270$ kw at 89.0 per cent lagging.

$$\text{Per cent line loss} = \frac{5270 - 5000}{5000} = 5.4 \text{ per cent.}$$

From the above it will be seen that a No. 2-0 B. & S. copper conductor is a satisfactory size to meet the electrical requirements.

It is important at this point to decide upon the make-up of this cable. One may make use of a simple stranded hard-drawn copper cable, a stranded cable with solid core of softer wire, a stranded cable with copper cable core, a stranded cable with hemp core, or a stranded aluminum cable.

The whole point of this range of selection lies in the strength of the central strand of the cable. Since the unit cable is made up of seven strands consisting of a central wire with six others of the same diameter wrapped spirally around it, it is clear that under severe stress the central wire receives the first impact of the load and may be ruptured while the six spirally wound layers are merely tightening down to a firmer bedding. The cable core (by the substitution of a cable of smaller wires giving the same diameter as the solid wire for the center) is thought to introduce an improvement in strength. A similar improvement also appears possible by introducing a central wire of softer temper so that while allowing extension under the strain it does not permit the remaining wires to lose their shape very much. The much discussed hemp core has only the feature of preserving the cable shape and a lesser number of conductors of larger size to recommend it. There may be some advantage in the lubrication afforded by the preservative used on the hemp, but this is problematical.

Before making a final selection, tests in any event should be made for tensile strength, modulus of elasticity and breaking strength of the material to be used. For simplicity the present study will be confined to a stranded, hard-drawn copper cable having a conductivity of No. 2-0 B. & S. solid copper wire. The effective area (mechanical) $= 0.1045$ sq. in. Since the breaking strength of such a cable may be taken for the purpose of this study at 60,000 lb. per square inch and the elastic limit at 30,000 lb. per square inch it is clear that the wire allows the use of an absolutely maximum strain of 6300 lb. approximately and a working maximum of 3100 lb. approximately (the elastic limit) giving roughly a safety factor of two for the theoretically worst strain possible. On this basis one can proceed to determine the maximum strain on straight run-away work on fairly level ground.

A transmission line is effected by all of the natural elements: heat, cold, wind, rain, sleet, etc.; practice has indicated that the limiting condition of span selection depends upon the maximum temperature and maximum wind velocity on the one hand and minimum temperature with sleet and moderate wind on the other. The effect of these elements will be shown in the following calculation:

For many parts of the country the U. S. Weather Bureau has been collecting various meteorological data for the last 30 years or more. From this source, therefore, may be obtained information as to the average, maximum and minimum temperatures, rainfall, sleet, thunder storms, etc., for all days of the year.

Temperature.—For the present discussion the temperature may be assumed to be —20 deg. Fahr. for the lowest and 130 deg. Fahr. for the highest, or a temperature variation of 150 deg. Fahr.

Wind.—The pressure brought upon the conductors and tower by the wind is an important one, and yet the constants for the wind are not uniformly agreed upon. The United States Government measures wind velocity by the anemometer and for this value a certain correction is necessary to determine the effective velocity. This correction is:

Wind Velocities— Indicated m.p.h.	Actual m.p.h.	Lbs. per sq. ft. for plane surfaces— Buck[1] and Smeaton $p=.005\ V^2$.	Marvin[2] (U. S. Wea. Bu.) $p=.004\ V^2$.	Berlin-Zossen Tests[3] $p=.0027\ V^2$ Calc.
0	0.	0.	0.	0.
—	—	—	—	—
10	9.6	.462	.369	.249
20	17.8	1.59	1.27	.859
30	25.7	3.30	2.64	1.78
40	33.3	5.56	4.44	3.00
50	40.8	8.33	6.66	4.49
60	48.0	11.50	9.22	6.23
70	55.2	15.30	12.20	8.24
80	62.2	19.40	15.50	10.45
90[4]	69.2	24.00	19.20	12.95

On cylindrical bodies the pressure is usually taken at one-half of that on a plane surface having the same projected area. The only tests on record as having been made on an actual cable strand indicates $p = 0.005\ V^2$ to be the correct equivalent value for plane surfaces.[4] This value will be used in the following calculations. In the report of the Berlin Zossen Electric Railway test a value $p = 0.0027\ V^2$ is deduced. This is carefully worked out from a number of readings and is worthy of note; there is no good reason to reject it save that while theoretically wind pressure can be as satisfactorily measured by a predetermined velocity of projection of a plane surface against the wind as the reverse, nevertheless in the case where it is to be applied to a transmission line the adoption of these values without further confirmation may be doubtful and unsafe. There is the additional advantage in the higher values that an excess allowance which may develop over actual needs is just so much of a factor of safety. The want of explicit values on the subject, coupled with the absence of detailed wind velocities for such conditions as prevail on the average transmission line is very marked. It is to be hoped that such information will be shortly forthcoming. In the meanwhile there seems to be every justification for generosity in allowances against wind pressure, sleet load, etc., especially on long spans and in localities where bad storms are likely to occur suddenly.

Although such an authority as Mr. H. W. Buck has stated[5] that "the records of the Weather Bureau are all taken at high

[1] *Trans. Int. Elec. Congress*, St. Louis, 1904, Vol. II, Page 318.
[2] U. S. Dept. Agriculture, Weather Bureau No. 364, Circular D, 3rd ed. Instrument Div. Anemometry.
[3] Berlin-Zossen Elec. Ry. Tests, 1903, McGraw Pub. Co., Page 29 and Plates XI, XII and XIII.
[4] Excerpt from letter March 2 to Messrs. Thomas & Neall, by C. F. Marvin, professor in charge, instrument division, Weather Bureau, U. S. Dept. of Agriculture.
"The values given in the table are already exprest in proportion to the indicated velocities of the anemometer. Unfortunately, however, investigations upon wind velocities at high velocities, that is, 50 to 100 miles per hour, can only be made with great difficulty and elaborate apparatus, and experiments over this range have not been adequate, as yet, to supply perfectly acceptable data. The pressures given in the table referred to are regarded as generally exact, but we are not prepared to vouch for the accuracy of the values above 50 miles per hour, and especially not at 100 miles per hour."
[5] *Transactions, Internat. Elec. Congress*, 1904, Vol. II, Page 320.

points, such as at the top of high buildings, etc., which are 100 ft. or more above the ground, the wind velocity decreases rapidly as the ground level is approached and at the level of an ordinary transmission line the velocity is about 30 per cent less than at a point 100 ft. or more above the ground," yet the differences in elevation of the several Weather Bureau stations involved, as well as the varying height of different parts of long line spans ranging from 60 ft. to 100 ft. maximum above ground, together with the natural exposures of one kind or another through which the line passes may subject the line, in parts at least, to such high wind velocities that the full reduction proposed by Buck should perhaps not be made. It is obvious that any extensive tower transmission with long spans requires a careful study of the weather characteristics.

Assume, therefore, that the maximum wind velocity as given by the Weather Bureau for the territory of this particular transmission project is 90 miles per hour indicated; the maximum noted simultaneously with sleet is 30 miles per hour indicated, tornadoes or similar vicious storms being very rare. By reference to the above table the actual velocities involved are found to be 69.2 and 25.7, respectively.

Sleet.—Sufficiently frequent occurrence in a given locality of as thick a layer as 0.5 in. warrants the use of 1 in. as the increased effective diameter of the conductor in calculating the wind pressures. Sleet is much more tenacious than is commonly supposed and although it probably does not form in a perfect cylinder, being thicker on the under side than on top of the conductor, the allowance here made is certainly none too much. In calculation, the unit weight of ice is taken as a basis.

Furthermore, fairly high wind with sleet is not so impossible as one might think. Experiments which anyone may make with a sleet-covered wire will show how hard it is to dislocate this coating by shaking. The Weather Bureau notes the presence of low-velocity winds simultaneously with sleet. The calculation is as follows:

Unit weight of ice = 57.4 lb. per cubic foot.

For our purposes we will use = 0.40 lb. per square inch per foot—that is, a cylinder having a length of 1 ft. and an end area = 1 sq. in.

Total weight of ice for this case is:

Diam. of No. 2-0 cable = 0.42
Sleet additional = 1.00

1.42 = total diameter under wind pressure.

Total area in square inches = 1.58 sq. in.
Copper area in square inches = 0.14 sq. in.

Ice area = 1.44

$1.44 \times 0.4 = 0.576$ lb. per linear foot of No. 2-0 cable for ice.

Unit weight of ice and cable.

No. 2-0 copper cable per foot = 0.406 lb.
No. 2-0 ice cable per foot = 0.576 lb.

Dead weight of copper and ice = 0.982 lb.

RESULTANT UNIT WEIGHTS.

Load	Wind m.p.h. indicated.	Wind strain per lin. foot.	Resultant weight and wind.	Angle of deflection from vertical at center of span.	Cos α.
0	0	0.	.406	0	1.00
sleet	0	0.	.982	0	1.00
sleet	30	0.195	1.00	11° 15′ app.	0.981
0	90	0.42	0.584	46° app.	0.695

At this point consideration should also be given to overhead grounded wire (lightning protection) and to telephone wires which are to be carried on the same tower.

Lightning Protection.—In a preceding paragraph the statement is made that the voltage and the allowable span determine the general dimensions of the tower. This statement is entirely true if line lightning protection is not considered. In some parts of our country lightning is so severe and often so local over a long transmission line that serious damage may be done, against which no amount of protective apparatus at the distant stations can be of any assistance. The Taylors Falls experiments[1] have shown this fact forcibly and they indicate the simple means available to give the desired immunity.

If a line lightning protection device is used, then since it consists of grounded wires suspended over or above the main conductors, the actual height of the tower is increased accordingly. Since the conductivity is of minor importance, use may be made of a stranded steel cable which is both light and effective. Calculations for the overhead ground wire or wires are made similarly to those for the main conductor.

Inasmuch as the grounded wire is not in general called upon to carry current nor is it necessary to insulate it from the ground, the attachment to the tower may be made directly by the best mechanical means available. Since the primary purpose of the overhead grounded wire is to carry off to earth static discharges or even direct strokes of lightning, all that is necessary is a complete metallic circuit between the conductor and earth, which is, of course, directly obtained when the line

SUMMARY.*

Standard span = 700 ft.

	Load. Copper	Cable. Temp.	Wind m.p.h. indicated. Max. strain assumed	Deflection.	Strain in cable lb.	Deflec. fr. vertical at center of span.	Effective sag (vertically).
1.	0	—20° F.	0	16.1	1540	0	16.1
2.	Sleet	"	30	20.4	3000	11° 15′	20.0
3.	"	32° F.	0	22.0	2740	0	22.0
4.	0	130° F.	0	21.8	1139	0	21.8
5.	0	"	90	22.9	1563	46°	16.0
Overhead Ground Wire. T max. by calc. to give same sag as in No. 2 preceding = 2,610 lb.							
1.	0	—20° F.	0	16.6	1090	0	16.6
2.	Sleet	"	30	20.4	2610	12° 35′	20.0
3.	"	32° F.	0	21.5	2425	0	21.5
4.	0	130° F.	0	20.8	870	0	20.8
5.	0	"	90	21.8	1340	51° 50′	13.5
Telephone "wire" T max. to conform to preceding requirement = 2,050 lb.							
1.	0	—20° F.	0	14.6	713	0	14.6
2.	Sleet	"	30	20.4	2050	15°	19.7
3.	"	32° F.	0	21.4	1890	0	28.40
4.	0	130° F.	0	19.1	545	0	19.1
5.	0	"	90	20.8	995	59° 40′	10.6

*F. O. Blackwell, *Transactions of Int. Elec. Congress*, St. Louis, 1904, Vol. II, page 345.

support itself is of metal. Again, since the kind of metal is ordinarily of no consequence for the purpose of protection the selection can be confined to such materials as promise either certain strength or certain endurance.

Since the best information in the matter of overhead ground protection calls for two or more such conductors above the circuit to be protected, every consideration of all possible interference with the electric circuit by breakage or otherwise must be well weighed before deciding on copper whose life is beyond question and steel cable whose lightness and strength are more desirable but the depreciation of which compared to copper is known to be very great. Where the investment is closely concerned, copper need not be considered; particularly at such prices as prevailed in 1907. There is much to be said for steel cable; with care in manufacture, together with thorough galvanizing, this material should be entirely satisfactory for the service.

For this problem two overhead ground wires are required. The details of their make-up, loads involved, etc., are listed below:

RESULTANT UNIT WEIGHTS.

High Strength 3/8-in. Extra Galvanized 7-Wire Crucible Steel Strand.

Load.	Wind, miles per hour indicated.	Strain per linear foot.	Resultant strain per linear foot.	Angle of deflection from vertical at center of span.	Cos α.
0	0	0	.295 app.	0	1.00
Sleet	0	0	.847	0	1.00
Sleet	30	.189	.869	12° 35′ app.	0.976
0	90	.375	.478	51° 50′ app.	0.618

This strand is rated by the makers, American Steel & Wire Company, with an elastic limit of 80,000 lb. per square inch and a breaking strength of 11,500 lb. or with an effective area of 7 wires 0.125 in. each in diameter 134,000 lb. per square inch equivalent. It should be noted that the apparently unusual strength of this material for the purpose is required to make its use effective as an overhead anchorage. In this way, without consideration of the additional advantages arising from the relative leverages of the various groups of wires, it will be

[1] *Transactions A. I. E. E.*, 1908, Vol. XXVII, May meeting.

clear that the two overhead ground wires may thus have sufficient strength to hold the tower in shape and position, even though all of the other conductors should fail.

Telephone Service.—The only question here is one of minimum size of wire permissible for the long spans involved; whether a steel wire would be selected for this service in place of copper wire on the score of greater strength or decreased first cost is a secondary matter. An investigation of sizes permissible leads to the selection of 9/32-in. special Siemen's-Martin strand.

RESULTANT UNIT WEIGHTS.

Special Siemen's-Martin 9/32-in. strand extra galvanized.

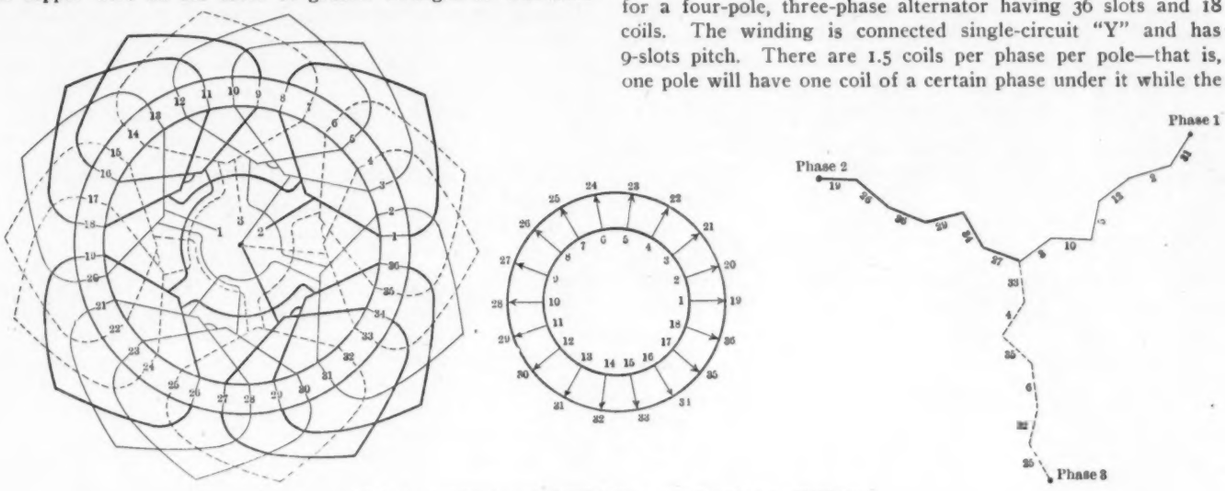
Load.	Wind. m.p.h.	Strain per linear foot.	Resultant strain per linear foot weight and wind.	Angle of deflection from vertical.	Cos a.
0	0	0	.17 lb.	0	1.00
Sleet	0	0	.662	0	1.00
Sleet	30	.177	.685	15° approx.	0.966
0	90	.291	.337	59° 40′	0.505

Modulus of Elasticity.—This is an important item and yet one not easily determined. Since the manufacturer usually gives an approximate figure, tests should be conducted on samples to cover this point. For this case the following values will be assumed:

Copper cable, 16,000,000.
Steel cable, from 18,000,000 to 23,000,000.
23,000,000 used.

The various loads to which the tower will be subjected by the conductors may now be designated. The summary is given on the preceding page.

In a subsequent article the above outline of conditions and requirements will be applied in the selection of towers for specific installations.



FIGS. 1, 2 AND 3.—SYMMETRICAL THREE-PHASE WINDING.

Alternator Armature Windings.

By Edgar Knowlton.

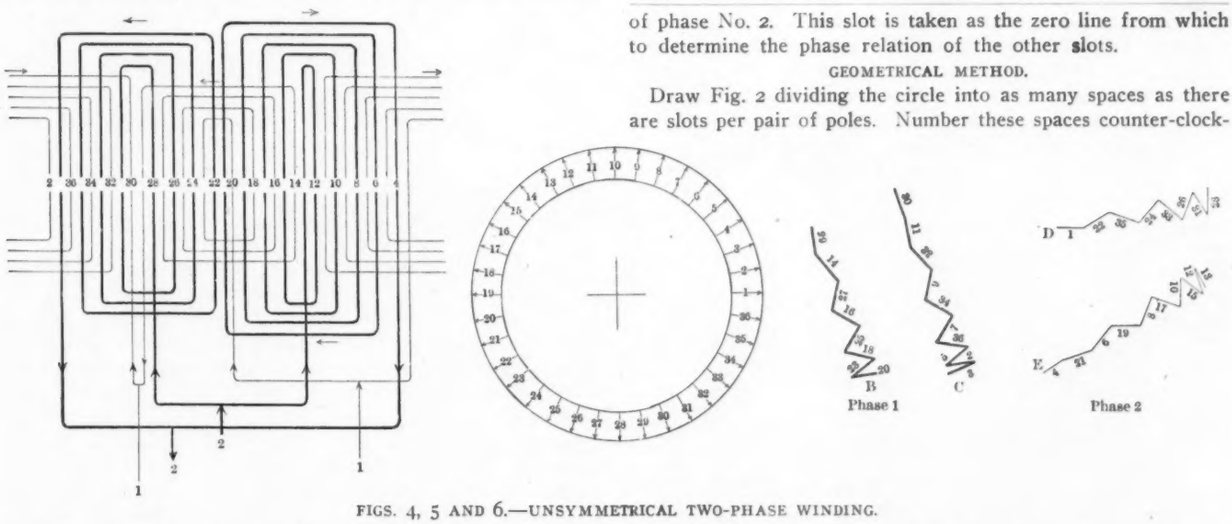
The following methods of determining the correctness of armature connections are of value principally when the connections are unsymmetrical. The first case considered is a winding for a four-pole, three-phase alternator having 36 slots and 18 coils. The winding is connected single-circuit "Y" and has 9-slots pitch. There are 1.5 coils per phase per pole—that is, one pole will have one coil of a certain phase under it while the adjacent pole will have two coils of the same phase. In Fig. 1 the first phase winding is represented by a light line, the second by a heavy line, and the third by a dotted line. Slot No. 1 is placed on the horizontal diameter to the right, and is the end of phase No. 2. This slot is taken as the zero line from which to determine the phase relation of the other slots.

No. 1.	No. 2.	No. 3.
3	27	33
10	34	4
5	29	35
12	36	6
2	26	32
31	19	25
21	9	15
28	16	22
23	11	17
30	18	24
20	8	14
13	1	7

GEOMETRICAL METHOD.

Draw Fig. 2 dividing the circle into as many spaces as there are slots per pair of poles. Number these spaces counter-clockwise, beginning as shown. This diagram shows the time-degrees displacement between the e.m.fs. generated in the various slots for any pair of poles. In this case the time-phase difference between adjacent slots is 20 deg. Make a table of the numbers of the slots through which each phase winding passes.

The first slot from the "Y" connections in phase winding No. 1 is No. 3. Draw line 3 in Fig. 3 parallel to line 3 in Fig. 2. Lay off on this line any suitable length to represent the e.m.f. generated in one slot. The next slot through which the winding of phase No. 1 passes is No. 10. The time-phase relation



FIGS. 4, 5 AND 6.—UNSYMMETRICAL TWO-PHASE WINDING.

of slot No. 9 to slot No. 1 is (3-1) 20 deg. = 40 deg. The time-phase relation of slot No. 10 to No. 1 is (10-1) 20 deg. + 180 deg. = 360 deg. The 180 deg. is added because the winding passes through slot No. 10 in the opposite direction to that in slot No. 1, as can be seen by the diagram Fig. 1. Proceed in this manner with slots 5-12-2-31. This gives the e.m.f. diagram for one pair of poles. The diagram for the balance of the slots in this phase (21-28-23-30-20-13) is a repetition, consequently it is unnecessary to draw them. Treat phase-windings Nos. 2 and 3 in the same manner. The results show the correctness of the connections.

APPLICATION OF THE TRIGONOMETRICAL METHOD.

In the accompanying table the sine and cosine of the time-phase angle of each slot is tabulated and added, giving consideration to the sign of the quantities according to the principles of trigonometry. For instance, in phase winding No. 3 there are cosines + 1.61334 and — 0.67365 which equals + 0.93969. The sine is — 5.32928 and the tan — 5.6713 which is the tan of 280 deg.

Phase Winding, No. 1.

Slot.	Phase Relation to Slot 1.	Cosine +	Cosine —	Sine +	Sine —	Tan.
3	2× 20= 40	.76604		.64279		
10	9×20+180=360	1.00000		0.00000		
5	4× 20= 80	.17365		.98481		
12	11×20+180=400	.76604		.64279		
2	1× 20= 20	.93969		.34202		
31	30×20+180=780	.50000		.86603		
	Total.....	4.14542		3.47844		+ .83910

Phase Winding, No. 2.

Slot.	Phase Relation to Slot 1.	Cosine +	Cosine —	Sine +	Sine —	Tan.
27	26× 20=520		.93969	.34202		
34	33×20+180=840		.50000	.86603		
29	28× 20=560		.93969		.34202	
36	35×20+180=880		.93969	.34202		
26	25× 20=500		.76604	.64279		
19	18×20+180=540		1.00000	0.00000		
				2.19286	.34202	
	Total.....		5.08511	1.85084		—.36397

Phase Winding, No. 3.

Slot.	Phase Relation to Slot 1.	Cosine +	Cosine —	Sine +	Sine —	Tan.
33	32× 20=640	.17365			.98481	
4	3×20+180=240		.50000		.86603	
35	34× 20=680	.76604			.64279	
6	5×20+180=280	.17365			.98481	
32	31× 20=620		.17365		.98481	
25	24×20+180=660	.50000			.86603	
		1.61334	.67365			
	Total.....	.93969			5.32928	—5.6713

+ .83910 = tan 40°
— .36397 = tan 160°
— 5.6713 = tan 280°

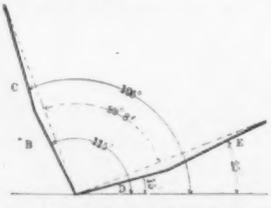


FIG. 7.—VOLTAGE RELATION IN TWO-PHASE WINDING.

The resultant voltage of phase winding No. 1 is displaced 40 time degrees from the voltage of slot No. 1. This is also true of slots 3 and 12. Assume that 200 volts are generated in each slot. The resultant voltage of phase winding No. 1 is

Cos (3-3) 20°		=	Cos	0°	=	1.00000
" (10-3) 20°	+180°	=	"	320°	=	.76604
" (5-3) 20°		=	"	40°	=	.76604
" (12-3) 20°	+180	=	"	360°	=	1.00000
" (2-3) 20°		=	"	20°	=	.93969
" (31-3) 20°	+180	=	"	740	=	.93969
						5.41146

or 2 (cos 0 deg. + cos 20 deg. + cos 40 deg) × 200 volts = 1082 volts for that part of the winding under consideration. The total for the phase winding is 2 × 1082 = 2164 and between phase leads is $\sqrt{3} \times 2164 = 3744$ volts.

A more complicated case is that of the winding indicated digrammatically in Fig. 4. This manner of connecting is chosen to simplify the mechanical connections in a very special case. The alternator has two poles, two phases, 36 slots, 18 coils, and it is desired to connect the winding in two circuits. The e.m.f. diagrams of Figs. 5 and 6 show that the connections are incorrect, there being 10 time degrees between the voltages of circuits *B* and *C* and the same time angle between that of the circuits *D* and *E*. The resultant voltages in the circuits of either phase are also unequal.

An inspection of the diagrams of Figs. 5 and 6 gives rise to the question as to the effect of omitting slots Nos. 3 and 30 in phase windings No. 1 and 13 and 4 in phase winding 2. These changes bring the e.m.fs. of circuits *B* and *C* into phase, but *D* and *E* are then 20 deg. out of phase.

The result of connecting circuit *B* in series with *C* and *D* in series with *E* is shown in Fig. 7. The difference in time-phase between the e.m.fs. of the two phase windings is 89 deg. 8 min. instead of 90 deg. The value is so nearly correct that probably no trouble would be experienced in actual service.

The Construction of High-Frequency Apparatus.

By George T. Hanchett.

THE average student who reads and understands the time-honored experiments of Tesla and Thomson in high-frequency work and who realizes the simplicity of the apparatus by which such startling results were reached, very often desires to reproduce the experiments on a small scale. When high-frequency phenomena were first discovered they were of academic interest only and had little practical value, except that they afforded a beautiful exemplification of the principles of inductance and capacity. The high-frequency discharge is now of commercial importance, being used in wireless telegraphy and in investigating the behavior of lightning arresters of various types, which are designed to deal with high-frequency condenser discharge.

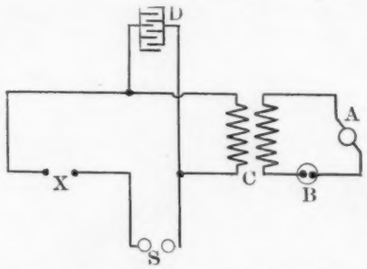


FIG. 1.—DIAGRAM OF CONNECTIONS.

The writer has had occasion to construct high-frequency apparatus and has encountered various details in construction which, if neglected, seriously impair results and may even render the efforts of the constructor futile. Some of the features are to be recommended by reason of their convenience and low cost, and although the subject is old it is believed that these considerations make a description of more or less interest.

Alternating currents of any of the commercial frequencies are best for producing the Tesla discharges. Very good results are obtained with 60-cycle current at 110 volts, using about 40 amp. It is necessary to step this potential up by a transformer of some sort from 10,000 volts to 20,000 volts. High-voltage, low-frequency current is passed directly to a condenser of the proper capacity, which is permitted to discharge across a short spark-gap, made preferably with screw adjustment and of moderately massive ball-shaped terminals. The discharge circuit of the condenser carries the high-frequency currents which it is desired to study, and the many beautiful and now familiar phenomena are obtained by connecting the different pieces of apparatus in series with this discharge circuit. An elementary diagram is shown in Fig. 1, where *A* represents the alternating-current source of supply, suitably controlled by a rheostat or adjustable inductance *B*. C represents the step-up transformer, *D* the condenser, *S* the spark-gap, and at *X* in the condenser discharge circuit is connected the apparatus on which it is desired to impress high-frequency currents.

The most expensive and troublesome part of the apparatus is the step-up transformer. Several ordinary transformers

may be used to obtain the high-tension currents, but it will be found better, if time and means afford, to construct a special transformer of the open magnetic-circuit, oil-insulated type, of the transformer consists of a fiber tube of the dimensions given filled with fine, straight iron wire. This tube is fastened tightly to a thick cover, which may be of wood turned up in a

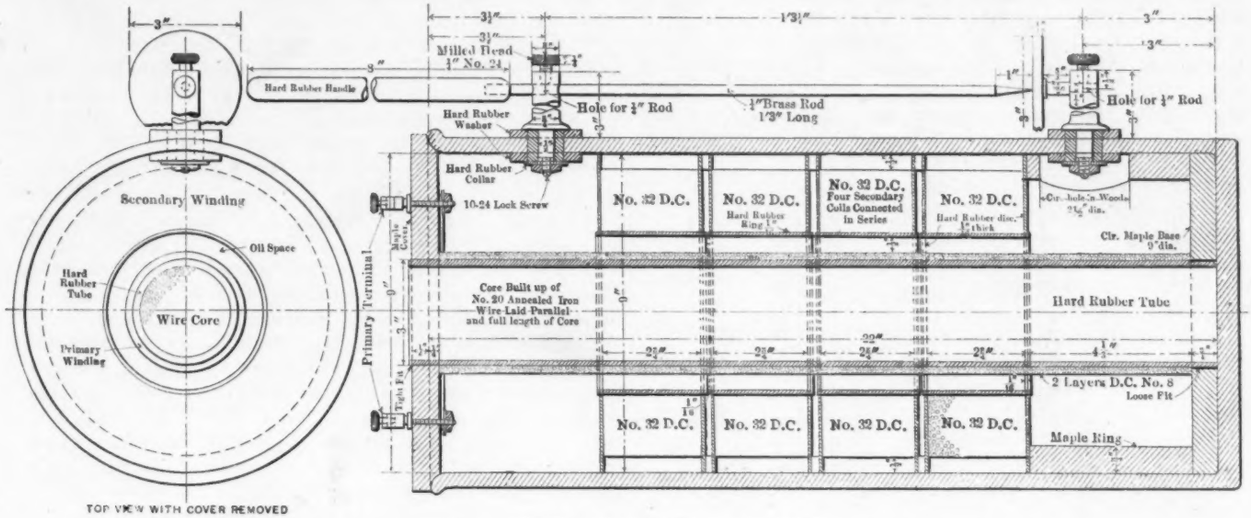


FIG. 2.—DETAILS OF STEP-UP TRANSFORMER.

for the surges that obtain in such a circuit are apt to puncture the insulation of the ordinary commercial apparatus. The writer has found a very successful arrangement in Fig. 2, which is a

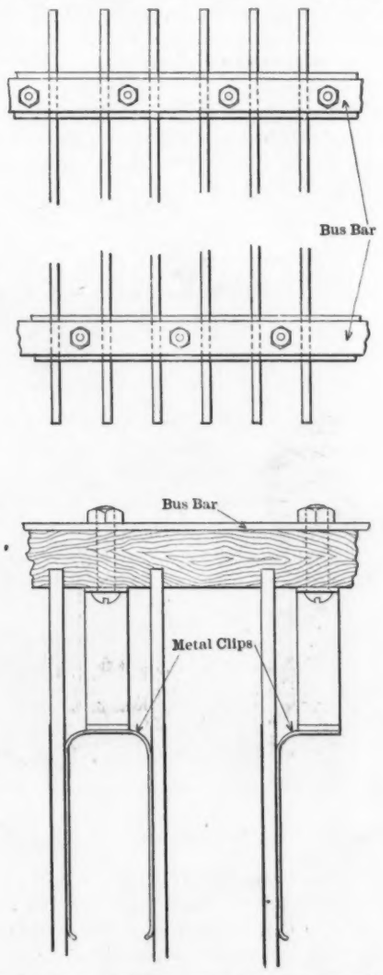


FIG. 3.—TOP AND SIDE VIEW OF CONDENSER RACK.

dimensional drawing of a transformer suitable for this purpose. The containing jar of this transformer is made of indurated fiber, which is oil tight and an excellent insulator. The primary lathe and impregnated with asphaltic compound. The two terminals of the primary may be brought to binding posts mounted on the wood. The advantage of this arrangement is found in the fact that removing the cover removes the primary coil also for inspection and also leaves the secondaries open so that they can be examined. The primary is wound with two layers of No. 8 double-cotton covered copper wire. Considerable care is necessary in insulating the layers from one another, particularly at the top where the primary coil is supported by the wood, for this top is likely to protrude out of the oil and between the layers at this point the highest difference of potential obtains. It is well, therefore, to use several layers of oiled linen to separate the primary layers at this point. The bottom of the indurated fiber jar contains a round disk of wood with a hole in the center which loosely fits the ends of the primary and keeps it central.

The secondary coils are wound on hard-rubber spools, made of tubes and collars, and using No. 32, double cotton-covered wire. Between each layer of wire should be placed a layer of unsized white paper, and care should be taken not to wind

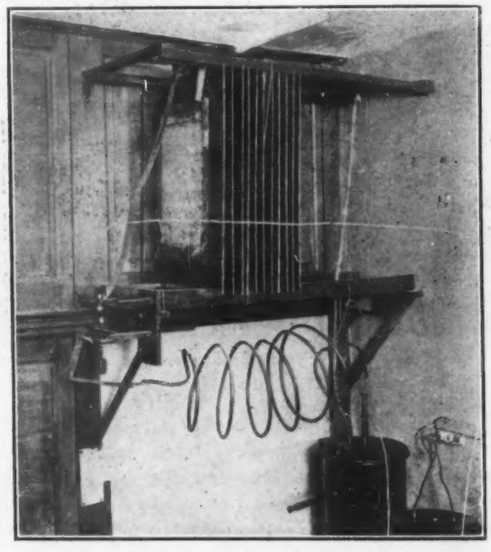


FIG. 4.—CONDENSER, SPARK GAP AND INDUCTANCE.

the layers clear across the full width of the spool. A space ¼ in. wide should be left at each end so that there will be no danger of the end turns dropping down between the spool col-

lars and the coil itself. The coils when completed should be boiled in paraffin, which should then be allowed to cool, and when the wax is of a mushy consistency the coil should be removed and pressed between two plates of glass with a weight. In this way much of the wax which would otherwise drain out between the interstices of the coil will remain there intact and afford valuable protection and insulation.

The finished coils may be assembled on the spools by slipping the latter through them, and the spools may then be placed in

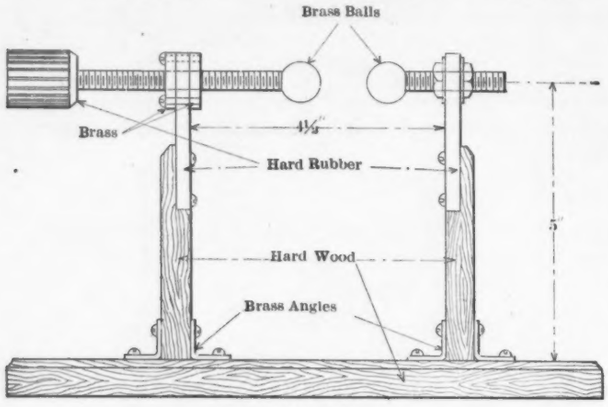


FIG. 5.—DISCHARGE CAP.

the jar, wooden rings being used as spreaders to separate them. Attention is called to the liberal spaces allowed between the primary and secondary, and when the jar is filled with a good grade of transformer oil the insulation between the primary and secondry is homogeneous and complete. An oil cock may be added at the bottom of the jar for the purpose of draining it and, as it is very hard to get the joints for the terminals tight, the jar may be placed in a metal pan which will catch all leakage.

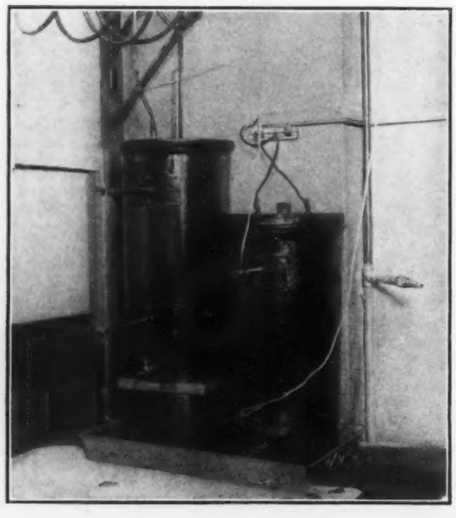
The secondary terminals of the transformers are attached to hard-rubber tubes threaded into hard-rubber plates, which may be bent to fit the contour of the jar by placing them in hot water and securing them by bolts. The joints may be made tight with thick shellac. It may be well to bring the secondary terminals out from the ends of the coils, using a number of twisted wires for this purpose, instead of a single wire, which is likely to break and perhaps burn off.

A coil constructed in this way serves not only the purpose of a transformer, but, used in connection with the electrolytic interrupter with direct current, will provide discharges of low frequency and very high tension, 75,000 volts to 100,000 volts, and may be profitably used for breakdown testing of insulating materials.

For the Tesla experiments, however, this coil should be excited with alternating current, and the current from the secondaries should be led off to charge a condenser which may be made in the following manner: A dozen plates of glass (ordinary window glass of double thickness will answer) should be provided and a wooden rack made to contain them. The plates of glass are 18 in. x 24 in. and are covered with tin foil on each side, a space being left between the edge of the glass and the tin foil of at least 3 in. It will be well to shellac the plates and the edges of the tin foil, and the tin foil can be fastened to the plates with shellac very advantageously. The plates are assembled in the rack, which may be made of strips of wood having equally spaced saw cuts, and a set of busbars may be mounted upon strips of wood with similar saw cuts and carrying clips which extend down between the plates and make contact with the tin foil. Fig. 3 shows how this may be done, and Fig. 4 shows a photograph of the actual condenser constructed in this manner. The arrangement is to be recommended rather than the more economical one of placing the plates closely together and using alternate strips of tin foil between them, for the reason that if any plate should be overheated and crack through sparking, it can be removed without disturbing the others.

The discharge gap may be mounted on a wooden frame; the discharge points being carried on light pieces of hard rubber and equipped with balls ⅝ in. in diameter. One of the discharge points should be screw controlled through a nut so that the gap may be varied. A drawing of this discharge cap is shown in Fig. 5.

The apparatus upon which high-frequency currents are to be impressed is connected at *X* and the discharge gap shortened, so that when the switch is closed, the discharge jumps across the gap making a very noisy white spark, which is inclined to be calorific and not sharply broken off, but which can be corrected by opening the discharge gap a little, after the discharge is once started. In fact, it will be found to be best to do this to obtain the maximum results. If an inductance consisting of a coil of copper wire, say No. 2-0 trolley wire, be wound 8 in. in diameter and with 6 turns, and connected across the points *X*, the oscillatory current will experience considerable difficulty in traversing it. If a spark gap be shunted around this coil, it will be found that a potential of from 8,000 to 10,000 volts exists there. A vacuum tube of any type will be brilliantly illuminated if connected in shunt around this apparent short circuit. Still



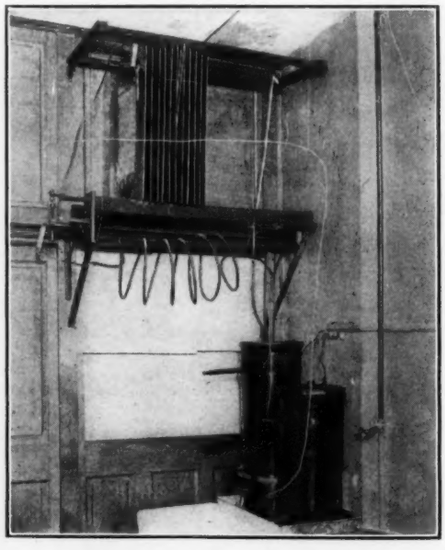


FIG. 6.—FRACTURED GLASS JAR OF TESLA COIL. FIG. 7.—TRANSFORMER AND TESLA COIL. FIG. 8.—GENERAL VIEW OF EQUIPMENT.

more puzzling is the fact that an incandescent lamp connected across the terminals of this coil, and apparently on dead short circuit, will light up brightly, but even under these conditions the experimenter will be presented with the curious phenomenon of the discharge striking across the terminals of the lamp within the bulb and also without, showing the existence of a high potential, and yet the filament will burn as it would under its normal 0.5 amp current.

A piece of No. 36 wire 3 or 4 ft. long, shunted across this coil will become red hot and burn out, and if the wire be coiled in approved magnet fashion on a glass tube with the insulated

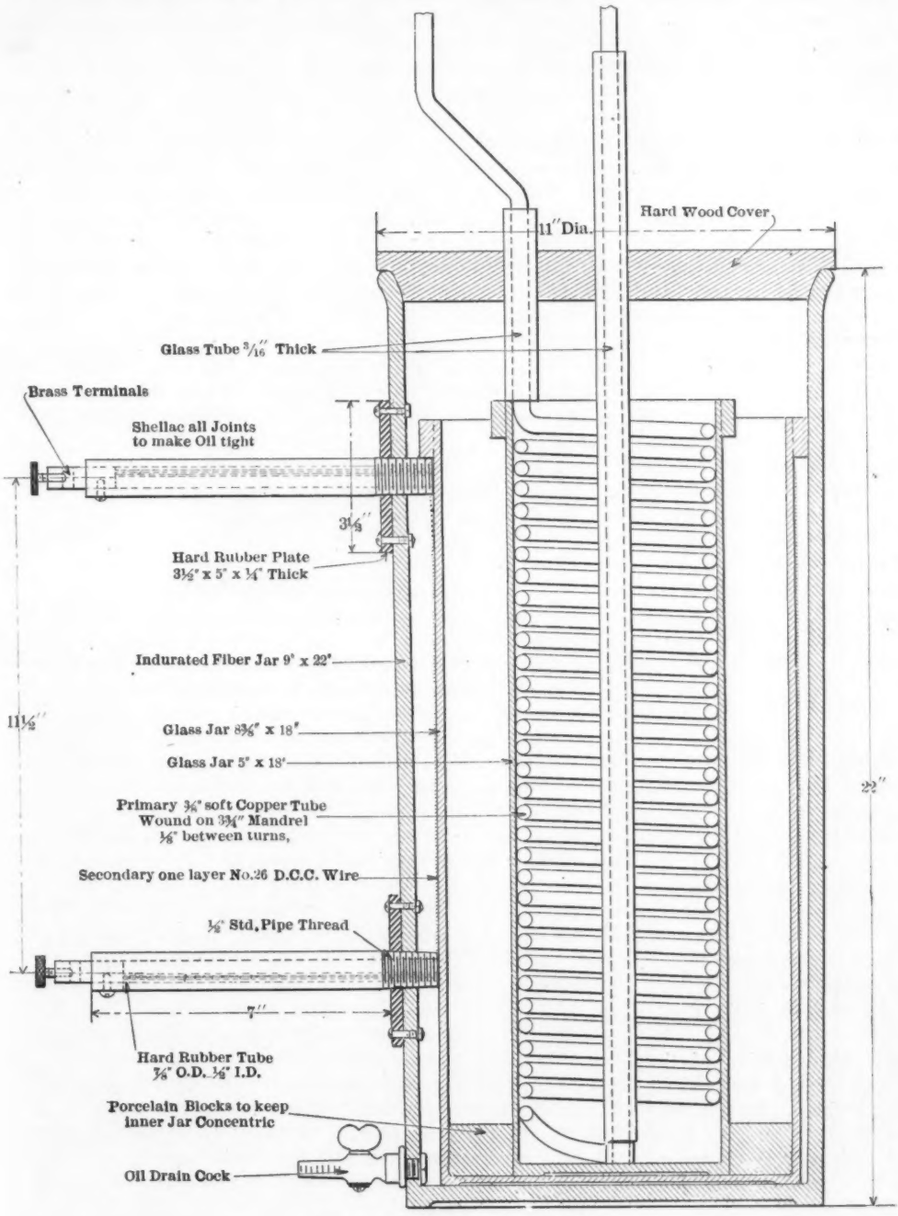

11" Dia.
Hard Wood Cover
Glass Tube 3/16" Thick
Brass Terminals
Shellac all Joints to make Oil tight
3½"
Hard Rubber Plate 3½" x 5" x ¼" Thick
Indurated Fiber Jar 9" x 22"
11½"
Glass Jar 8⅜" x 18"
Glass Jar 5" x 18"
22"
Primary ⅜" soft Copper Tube Wound on 3¾" Mandrel ⅜" between turns,
Secondary one layer No.26 D.C.C. Wire
½" Std. Pipe Thread
7"
Hard Rubber Tube ⅜" O.D. ½" I.D.
Porcelain Blocks to keep inner Jar Concentric
Oil Drain Cock

FIG. 9.—DETAILS OF TESLA COIL.

turns in close proximity and connected as above described, the current will jump from turn to turn on the coil rather than go through it. A very pretty experiment can be made by connecting at the point *X* a pair of busbars across which are shunted a spark gap, a vacuum tube, a 110-volt lamp, a 50-volt lamp, and at the extremities of the busbars a dead short circuit. With a little adjustment and manipulation, all of the lamps and tubes will light up simultaneously, while sparks will jump across the gap.

The Tesla experiments are not complete unless the step-up Tesla transformer is constructed. The coil described below is capable of producing voltages in the neighborhood of 150,000, and must, therefore, be insulated with a great deal of care. The primary coil consists of about 30 turns of No. 2-0 trolley wire, or a thin copper tube of the same diameter. This wire or tube is stiff enough to be wound in a single helix, having a return through the center, as shown in Fig. 6. The wire or tube should be coiled inside of a long glass jar, and one of those commonly employed in preserving specimens in alcohol will be found very suitable. The jar shown in the drawing is equipped with a heavy lip, the top of which is ground flat. The primary terminals are brought out through heavy glass tubes through the wooden cover, as shown in the drawing, and connected to the point *X*, Fig. 1.

The secondary coil consists of about 500 turns of No. 26 wire wound upon the outside surface of a second glass jar of considerably larger diameter than the first, but of about the same height. Care should be taken to wind these coils so that they do not pass beyond the high-tension terminals, for if this is not done, the turns beyond are likely to short-circuit against the lead brought up from the bottom of the jar or down from the top as the case may be. The coil should end at the terminals. The jar may be shellacked before winding the coil and allowed to dry, and after the coil is completed, a second coat of shellac should be given to prevent the wire from unwinding when manipulated. Double cotton-covered wire should be used.

The whole outfit may be immersed in oil in an umbrella jar of the same type as was used in the manufacture of the high-tension transformer, but it will be well to bring the terminals out farther in the case of the high-tension transformer, as the discharge is very unmanageable and will be found to strike into anything that may be within convenient reach. If the terminals are too short, the discharge will strike through the indurated fiber and oil back to the coil, and is likely to snap the wire of which the secondary is wound as neatly as if it were cut with a pair of shears. The terminals should be 12 in. apart. Like the case of the high-tension transformer, it is well to equip the jar with a drain cock.

The insulation of the Tesla coil may seem extravagant, but in the writer's opinion it is none too good, and perhaps may be improved upon. In the first experiments, the writer endeavored to construct a coil omitting the central jar, with the result that the jar was heavily punctured, the inside splintered and gnawed by the discharge, and the bottom of the jar was found to contain at least a heaping teaspoonful of powdered glass. This rupture is somewhat interesting for the reason that it was beyond all doubt the result of many successive punctures, and from the length of the rupture it was evident

that the discharge did not simply puncture one hole and enlarge it, but punctured again in another place rather than overcome the inductance of the slightly longer path through the original hole.

Owing to the fact that the high-tension terminals of the Tesla coil make everything in the vicinity of opposite polarity by electrostatic induction, this coil should be well insulated from the ground. This may be conveniently done by setting the whole jar on a heavy piece of marble or glass resting on a second indurated fiber jar. The photograph showing the high-tension coil and the Tesla coil in action illustrates a suitable arrangement. In this case both the high-tension transformer and the Tesla coil are contained in a shallow iron pan.

Vacuum tubes of any length can be illuminated by simple contact with one terminal. The current from these terminals is not dangerous, although the shock obtained by taking both terminals in the hands would probably be somewhat uncomfortable, and it is well to take the discharge, if it is to be taken into the body, through a metal rod so as to avoid burns at the point where the discharge enters. The experimenter may seat himself upon an ordinary wooden stool, keeping his feet clear from the floor, and need not fear to take from one of the terminals of the Tesla coil a fat, hot spark 6 in. long, using, of course, a metal rod to protect his fingers against burning. He may hold in his free hand a wire leading to an ordinary 8-cp incandescent lamp, another experimenter holding the second wire, but standing on the floor. Enough current will be transmitted through his body to light the lamp. Or seated upon the stool in this way, he may ignite the gas with his fingers, or may light vacuum tubes by touching them, or deliver sparks to an observer standing upon the floor; in fact, there is no end of variations of phenomena. In conclusion, the writer would earnestly caution the experimenter to confine these experiments to the discharge from the Tesla coil alone. The terminals of the high-tension transformer are highly dangerous, and any wires connected with them are, of course, equally so, and should be adequately supported and securely placed beyond the range of accidental contact.

Methods of Firing Soft and Hard Coal.

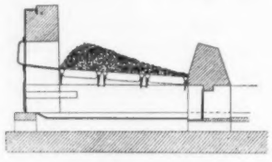
By Wm. Kavanagh.

When soft coal is used straight—that is, unmixed with hard coal dust—the coking method of firing is superior to either the pancake, humpback or scoop methods, because by this means very little gas is allowed to escape to the chimney unconsumed. In order to carry on the coking method successfully, wedge firing should be used, the thickest end of the wedge being against the furnace door and the wedge tapering rapidly toward the bridge wall, as shown in the accompanying illustration. Having built up a heavy wedge, the furnace door is closed and the fire allowed to do its work until the steam gage indicates a slight drop in pressure, say, 1 lb. or 2 lb. The furnace door is then opened and the coked portion of the wedge is pushed toward the bridge wall. The fire should be closely scanned to see that no cold air is finding its way into the furnace through the back of the grate bars, and the front of the furnace should again be filled with a fresh charge of coal. This method of coking should be alternately applied to each side, if more than one door is fitted to the furnace. In this way one side of the fire is coked and doing its work while the other side receives a fresh charge of fuel. The thinnest part of the wedge being against the bridge wall, more air is admitted here than in the heavier portion of the wedge, and hence the back of the furnace becomes a highly heated region through which the liberated gases from the front portion of the furnace must pass. This insures their complete combustion and renders the furnace very efficient.

If the fire becomes sluggish and burns with difficulty, it is a sign that there is too much resistance offered to the air in its passage through the fuel bed. In such a case, the slice bar should be pushed underneath the fuel and close to the grate bars, when by resting the slice bar on the dead plate the coal may be lifted gently from the bars. This process of slicing should be practised across the entire furnace; but in no case should the slice bar be allowed to break through the surface of the fire. It will be found that in this way the intensity of the fire may be increased with consequent greater evaporation.

Bituminous slack or soft coal dust can be successfully burned by first building a fire out of lump coal and then covering it with slack previously well wetted. The wet slack should be spread over the entire surface of the furnace bed and allowed to cake and afterward coke. The slice bar may then be used to lift the coked bed and permit the air to pass through the body of the fuel more readily. When flames appear on the surface of the wet slack, another layer should be applied and this method of firing continued until a bed heavy enough to suit draft and load is obtained. If the draft is of sufficient strength, a medium fire should be built up and after this has been properly sliced, the fire may be allowed to grow or increase in temperature. This method of firing will be found to give good results, especially since the furnace door need not be opened often. Bituminous slack can also be burned when mixed in equal proportions with hard-coal dust by first wetting the mixture and then firing it after the manner just described.

There are numerous grades of anthracite coal employed for the generation of steam, known as "bird's-eye," "rice," "buckwheat" and "pea coal"; the buckwheat and pea coal are numbered according to the different sizes. The great object in the firing of any grade of coal is to use as little as possible and at the same time maintain satisfactory steam pressure. In



WEDGE FIRING.

order to accomplish this the heat of the furnace, or at least a portion of it, must be kept at a high temperature so as to ignite the rich gases as they are formed and effect their combustion before they escape beyond the boiler-heating surface. The means by which this is done is as follows: Having built up a clear, clean fire, one side may be lightly covered and allowed to burn; then at the next firing the fuel may be thrown on the other side of the furnace and in this way the sides of the furnace may be alternately covered. The uncovered side is, therefore, at a high heat, and the gases generated from the covered side are thus burned and a useful effect on the heating surface of the boiler is the result. In firing any of the small grades of anthracite, the expert fireman is capable of spreading a shovelful of the fuel over one side of the furnace, the coal falling evenly all over the entire surface. If the furnace is extra large it may require two shovelfuls to cover the one side, but in general one side of a furnace 5 ft. x 6 ft. in size can be thinly covered with one or two shovelfuls of coal. It requires some experience to throw the coal in this way, but this may be easily acquired by practice. In learning to throw the coal as described, the fireman should practise with both hands; it is important to fire right- and left-handed in order to cover the fire properly.

Economy is not always realized in sprinkling one side of the furnace at a time, owing to the frequency of opening the furnace door and thereby admitting much cold air. There is more economy in firing one side fairly heavy and allowing it to become incandescent before covering the other side. "Fairly heavy" does not mean shoveling on great quantities of coal. The depth of the new covering of coal depends in a great measure on the intensity of the draft. With a strong draft, the thickness of the bed can be increased, while with a weak draft the fire must be thin. Right here experience is required in order to obtain the most satisfactory results.

There are two practical ways of cleaning fires. One method

is as follows: About half an hour before cleaning time the back of the fire should be coaled heavier than usual to insure a sufficient quantity of live coal to light the fresh fuel which will be used in building up the new fire. The front of the bed should be allowed to burn out; and if good judgment has been used there will be very little fire to pull out on the boiler-room floor. The slice bar may then be run under the burned-out portion of the fire and the ashes and clinkers broken up. The "lazy bar" may now be put in position and the ashes hauled out of the furnace. The good fire may then be pulled to the front, and the remaining ashes at the back raked down through the bars with the rake or "devil's claw." Any clinkers remaining may be jumped over the fire and hauled out of the doors. The good fire should be spread over the grate surface and a light covering of green coal thrown on. The furnace door should then be closed and the coal allowed to burn until incandescent, when fresh fuel may be again applied. After two or three light coverings the fire will be sufficiently strong to make steam.

The other method consists in cleaning one side of the furnace at a time, then coaling, and when the fuel becomes incandescent the other side is cleaned and built up in a similar manner. If dumping bars are used the good fire may be pushed back and the ashes in front dumped. The good fire can then be pulled to the front bars and the back portion dumped. The fire should then be spread over the surface of the grate bars and a light layer of coal thrown on and allowed to burn briskly. After the first covering is well ignited another shovelful or two of coal may be thrown on, and so on until the fire is hot and deep enough to continue in regular operation.

The Prevention and Removal of Boiler Scale.—II.

By W. H. WAKEMAN.

IN the previous article three boiler compound feeders were described. None of these is capable of holding very much of the softening solution, and where a device with sufficient capacity to hold several gallons of compound is desired, that shown in Fig. 1 is applicable. This is intended more especially for cases where the scale resolvent is purchased in dry form, after which it must be dissolved in water, and as it is advisable to prepare a weak solution the feeder ought to be large accordingly. When this is not required for immediate use the globe valve 2 is opened, the cross valve 3 is closed and valves 4 and

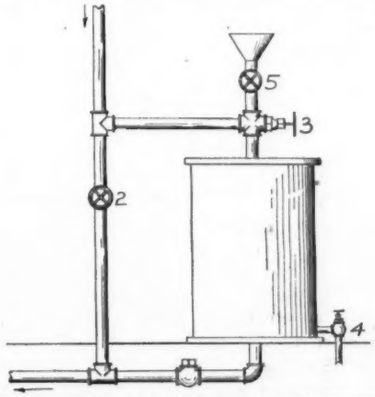


FIG. 1.—FEEDER FOR DRY SCALE RESOLVENT.

5 are opened. This allows water with which the body is filled to drain into the sewer. If the feed pump is in operation when this is shut off care must be taken to handle these valves in the order named so as to permit water to pass through without obstruction. When more compound is to be put into the boilers valve 4 should be shut and the body filled or the desired quantity of the mixture poured in and enough water added to fill the feeder in order to exclude the air. Then valve 5 should be shut, valve 3 opened and valve 2 closed, which will cause water to circulate through the body of the feeder, carrying the compound with it.

Fig. 2 illustrates a boiler-feed pump, a feed-water heater and a water purifier, in the order named. The combination is operated as follows: If water is to be pumped directly into the boilers (without passing through the devices shown), valve 2 is opened, while valves 3, 4, 5 and 6 are closed. When water

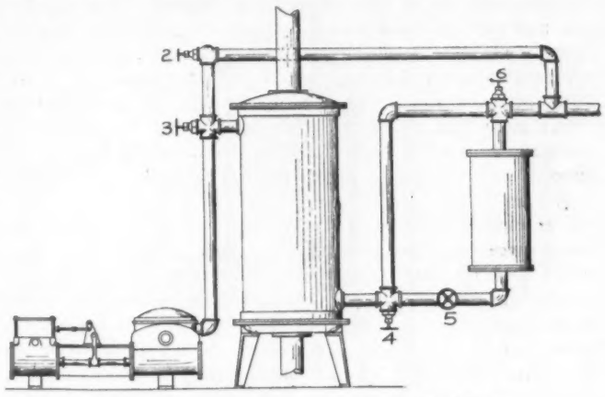


FIG. 2.—FEED PUMP, HEATER AND PURIFIER.

is to be sent through the heater only valves 3 and 4 should be opened and valve 2 closed. To feed through both heater and feeder valves 3, 5 and 6 are opened and valves 2 and 4 closed. By operating these valves in the order named the danger of shutting off all passages at once will be avoided.

It will be noted that no provision is made for filling this purifier with compound, for the simple reason that none is used. The device is patented and users are not informed concerning its contents except to state that it contains plates which destroy the affinity of the small particles of scale-making impurities for each other, and for the boiler shell and tubes. The effect of this is to preserve them in granular form, hence they can be blown out while the boiler is under pressure or thoroughly washed out when it is cool and nearly empty. Care should be taken to clean a boiler frequently if it was badly scaled before this device is applied, as there is danger of burning the plates where pieces of old scale accumulate and prevent water from absorbing the heat rapidly, provided the purifier does the work for which it was designed. This device is called a purifier by the manufacturer, but it is difficult to

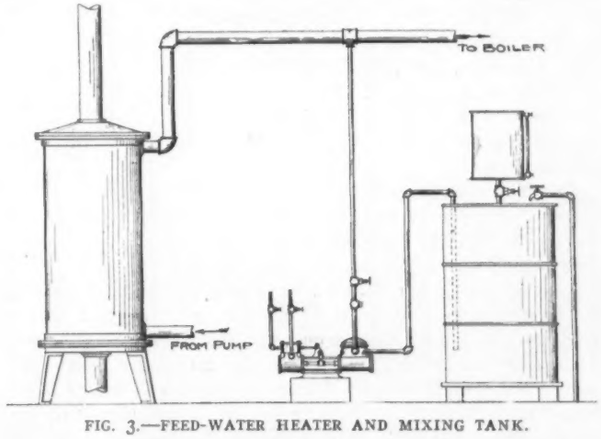


FIG. 3.—FEED-WATER HEATER AND MIXING TANK.

understand how any device can be properly called a purifier that does not remove impurities from the feed water. It only prepares them to be removed by other means, for if a boiler should be equipped with one of them and then operated for a year without being blown down or opened for thorough renovation there would be just as much foreign material in it as if the device had never been applied. It appears as if the name "scale preventer" would be more appropriate.

Fig. 3 illustrates a feed-water heater at the left hand into

which water from the pump enters and after being duly heated it is sent to the boiler, as shown, but a scale-removing compound is pumped into the hot feed-water on its way to the boiler by a small pump provided for this purpose. A mixing tank is shown at the right in which the required quantity of compound is prepared. The small pump takes it from this and delivers it into the feed pipe, as shown, at any desired rate. If a certain quantity of the compound, undiluted, is put into this tank and enough water added to fill the same, by running the pump slowly, it is possible to secure a very slow delivery, which is usually considered better than to send it in quickly. After all of the compound is taken out of the tank (to use a common expression, which means the greater portion of it), a comparatively large quantity of clear water ought to be run in and pumped out, in order to secure the full benefit of all material used.

If a small quantity is prepared each day this precaution becomes more important than if a much larger amount is used once a week or a month, as the possible waste is a greater percentage of the total. This is especially recommended where several boilers are in a plant, in order to distribute the remedy evenly, for if, say, 5 gal. of the diluted article is intended for each boiler separately, enough water should be used to insure the actual delivery of this amount. Unless intelligent attention is given to this matter some of the boilers will receive more and others less than their share, which is evidently not good practice. Even the plan of feeding it nearly continuously is not proof against this evil, because the average fireman will use more water in some boilers than in others, hence the compound will not be evenly distributed.

It is quite possible for one boiler of a battery to receive more than its share, even if each uses the same quantity of water. Suppose that the specific gravity of the compound is less than unity, or the standard for pure water. A large feed pipe is located across all of the fronts, with a branch pipe coming out of the top for each boiler. In this case the compound will travel along the upper side of the main pipe and more than an equal share of it will go into the first branch pipe. If it is practicable to shut off the feed water from all boilers but one, and then force the desired quantity of compound into that one, it will insure an equal distribution of the scale resolvent, which is an important consideration.

Fig. 4 illustrates a compound feeder that is fastened directly to the feed pipe, but there is nothing to prevent the feed water from taking a straight course past the device and if it follows the law which causes anything that is forced into motion, to take the path which offers the least resistance, but little water will circulate through the body. However, the compound will disappear if given time enough for the process, but it is not a positive motion.

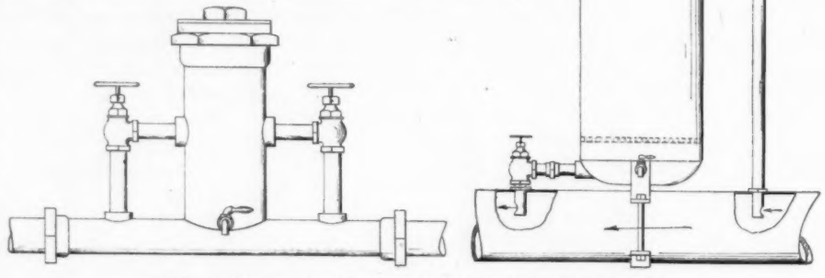
The device shown in Fig. 5 must be located on the feed pipe so that water on its way to the boiler will flow as indicated by the large arrow. If for any reason it is not practical to do this, the feeder should be turned from its present position on the pipe so as to bring the faucet on the opposite side. The long vertical inlet pipe which is surmounted by an angle valve will then be at the left instead of the right-hand. This pipe is extended into the feed pipe with an opening that is turned toward the advancing water, hence a portion of it is deflected into this pipe and thence through the feeder, taking the compound with it. The cover of this feeder is held in place by a strong wrought iron clamp and two screws. This cover must be packed in order to make it water-tight; but the same rubber gasket can be used many times if care is taken to coat it with graphite, on one side, and to put the cover always in the same position.

It requires more coal under certain conditions to evaporate a given weight of water in a boiler that is coated with scale than it does in a clean boiler, but the difference is not as great as it is sometimes represented to be. It is claimed that scale 1/16 in. thick causes a loss of 13 per cent of fuel, and if this thickness is increased to ⅛ in. the loss is raised to 28 per cent, while ¼ in. of scale causes a loss of 60 per cent. It would be a difficult matter to find a boiler that is coated with scale ¼ in. thick on every square foot of its internal surface, but it is not impossible to locate one or more that are partially coated to this extent, while nearly all of the remaining surface carries more or less scale on it, but if such a boiler is cleaned, the resulting economy will not be a saving of 28 per cent, which is a reasonable average for a boiler that carries scale ¼ in. thick on some of its internal parts, and much less on others.

This difference is accounted for on a rational basis as follows: Boiler scale is not all alike; some of it is porous, while other kinds are almost or quite as dense as porcelain. Taking the worst specimens, it is found that its conductivity, when compared with iron plate, is as 1 to 37; therefore, if scale 1/32 in. thick cleaves to the iron, it is equivalent to increasing that iron 1 in. in thickness. That comparison looks formidable, but from extensive and carefully conducted experiments made by eminent engineers the facts given below were secured.

The difference in temperature between the furnace and the internal surface of the boiler plate varied from 301 deg. Fahr. to 1128 deg. Fahr., and the difference in thickness of plate was just 1 in. In order to reduce the results secured from these tests to a common base, the rate of transmission of heat per square foot of surface for each degree difference of temperature is given, which seems to be an impartial method. When all results are reviewed it is found that taking the thick plate as a standard the thin plate allowed 50 per cent more heat to pass through to the water.

Applying this to practice, suppose that a boiler with plates ⅜ in. thick has a coating of scale of uniform thickness that is equivalent to one additional inch, as above explained. Steam is carried at 100 lb. by the gage, and conditions are such that the temperature of the escaping gases is 340 deg. Fahr., or practically equal to the temperature of the steam. An efficient boiler compound is introduced in an effective manner, removing all of the scale from close contact with the iron, throwing it down to the bottom, whence it is removed through the manhole, thus leaving the plates and tubes as clean as they were when new. In order to preserve a proper basis for comparison of results, no change is made in other conditions. Heat now passes much more rapidly from the furnace to the water through the plates that are exposed to the direct action of the flames, and in a tubular boiler the tubes near the rear head transmit the heat more rapidly than before, consequently when the products of combustion have reached a point about midway between the two heads their temperature is reduced to 340 deg. as they were when arriving at the front head under previous conditions. This temperature is maintained until the gases are discharged into the stack, because no more heat can pass from them into the water on account of the equilibrium of temperature that has been established. In some cases it is possible for heat to pass from the water into the gases by the law of nature which causes heat to pass from a hot to a comparatively cool substance.

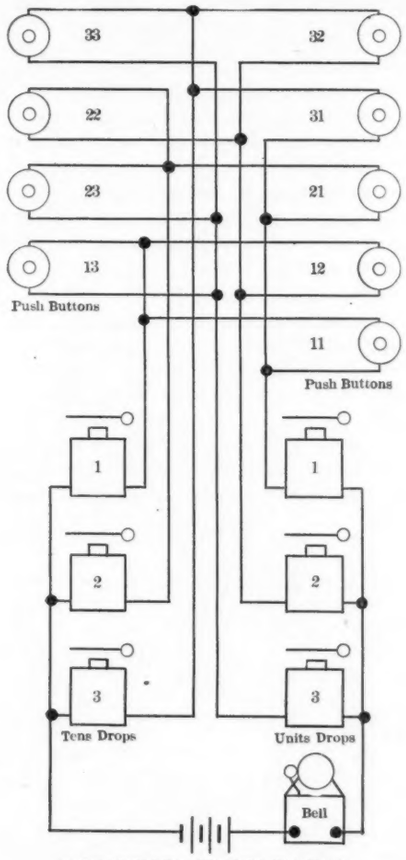


FIGS. 4 AND 5.—BOILER COMPOUND FEEDERS IN PIPE LINE.

LETTERS ON PRACTICAL SUBJECTS

A METHOD FOR WIRING ANNUNCIATORS.

The object of the scheme here described is to lower the expense of installing an annunciator by reducing the number of drops and the amount of wire required. To make clear the method, a special case is discussed. Assume that it is required to install an annunciator in a three-story building, on each floor of which are three rooms to be connected to the annunciator. A suitable method of numbering these rooms is to call the first-floor rooms 11, 12, 13, the second-floor rooms 21, 22, 23, and the third-floor rooms 31, 32, 33. An annunciator with six drops is used. Three of these drops are designated as tens drops and bear the numbers 1, 2, 3, respectively. The other three are units drops, also bearing the respective numbers 1, 2, 3. For convenience in reading the indications, the tens drops should be to the left of the units drops. Pushing a button in any room actuates two drops, corresponding to the tens and units figures in the number of the room. The manner in which this is accomplished is shown in the illustration. One pole of the battery is connected to one terminal of each of the drop magnets in one group, and the other pole of the battery is similarly connected to the other group. A bell may be introduced in one of these connections, as shown. The remaining terminals of the drop magnets are connected to the line wires. There is a line wire for every drop. Each push-button is connected to the line wires corresponding to the drops which that button operates. In this case six drops are required instead of nine, but where the number of rooms is greater, a greater proportionate saving is possible. To connect an annunciator with 90 rooms, numbered from 10 to 99, by this method, an annunciator with nine tens drops, numbered 1 to 9, and 10 units drops, numbered 0 to 9, is required, a total of 19 drops. The amount of wire saved by this method depends on the relative location of the push buttons, and a general discussion of it would be of little value. This arrangement is unsuitable where calls are received by the annunciator in rapid succession, for if a second call is received before a previous one is noted, it is generally impossible to determine from which rooms the calls proceeded.



ANNUNCIATOR WIRING DIAGRAM.

ELIZABETH, N. J. F. P. MCDERMOTT, JR.

A PECULIAR GROUND.

A consumer filed a complaint at the office, saying his electric light bills for his residence were high. The electric meter was tested and found to register correctly. The wiring was also tested and reported clear of grounds. When these tests were made, it was reported that, with all lamps turned off, the meter disk would not rotate. The connected load on the meter was 38 16-cp lamps, service being supplied from a two-wire overhead, secondary system which was grounded outside of the building in the regular way. Sometime later the consumer complained that frequently his electric meter would run when all the lamps were turned off.

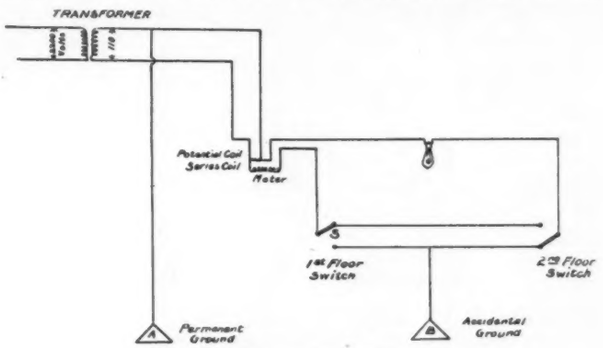


FIG. 1.—DIAGRAM OF CONNECTIONS.

The writer was requested to make a personal investigation, and upon arriving at the house, found the meter running and registering at the rate of 85 watts per hour, with all lamps turned off. The trouble was traced to a circuit which had two three-way switches for operating the first and second-floor hall lamps. The first-floor switch was turned on and the second-floor switch turned off and the meter stopped. It was found that each alternate time the lamps were turned on at the first-floor switch and turned off at the second-floor switch, the meter kept on running, although no lamps were burning. An accidental ground was located on one of the two wires which connect the two three-way switches. Referring to Fig. 1, it will be readily seen that switch *S* connects the accidental ground to the ungrounded side of the system through the series coil of the meter, and causes registration, whereas, in Fig. 2, the accidental ground is connected to the grounded side of the system, and there is no registration. The accidental ground was cleared, and there was no further trouble.

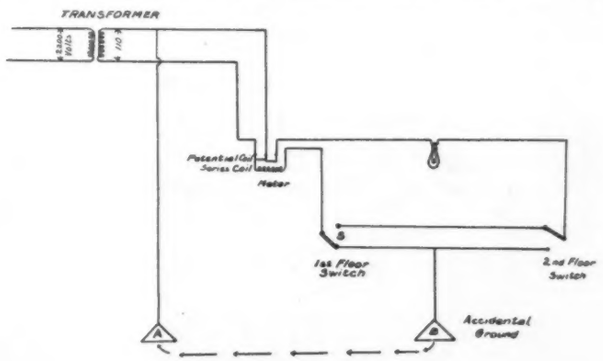


FIG. 2.—ACCIDENTAL GROUND.

MT. VERNON, N. Y. F. J. MURMANN.

TROLLEY-WIRING A PUBLIC SQUARE.

It recently became necessary to lay out the wiring for trolley supports in a public square, the sides of which were each 160 ft. long, with intersecting streets 40 ft. wide. As represented by Fig. 1, the wiring did not cross but intersected through the medium of four 90-deg. curves. The wiring could

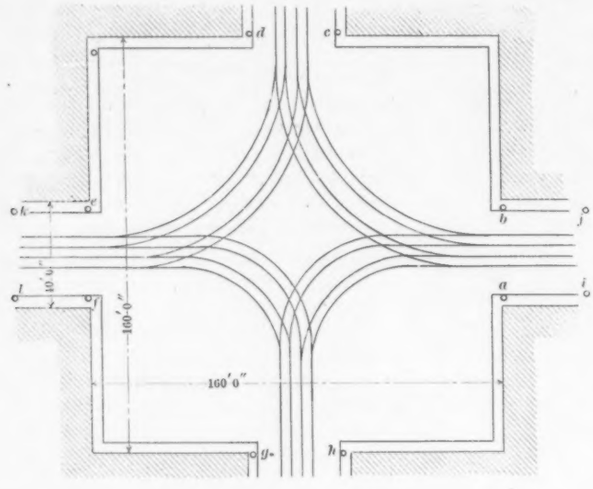


FIG. 1.—SQUARE TO BE WIRED.

not be attached or fastened to any of the buildings, but must needs be supported entirely by the poles *a, b, c, d, e, f, g* and *h*, which were located as shown at the intersections of streets and square, but placed flush with the building line, and also flush with the curb in the street edge of the sidewalks, which are shown extending entirely around the square. Fig. 2 represents the manner in which the wiring supports were laid out and suspended entirely from the trolley-wire poles. It will be noted that the entire wiring is attached directly to and supported by poles *a, b, c, d, e, f, g, h*, but these poles are in turn supported by guy-wiring from the tops of these poles to the foot of each adjacent pole, as shown at *i, j, k, l*, where poles *a, b* are guy-wired to the lower portion of poles *i, j*. This prevents the load of trolley wiring and its supports from pulling the tops of the poles toward the center of the square. The entire load of wires and supports is carried by the eight wires *a o, b o,*

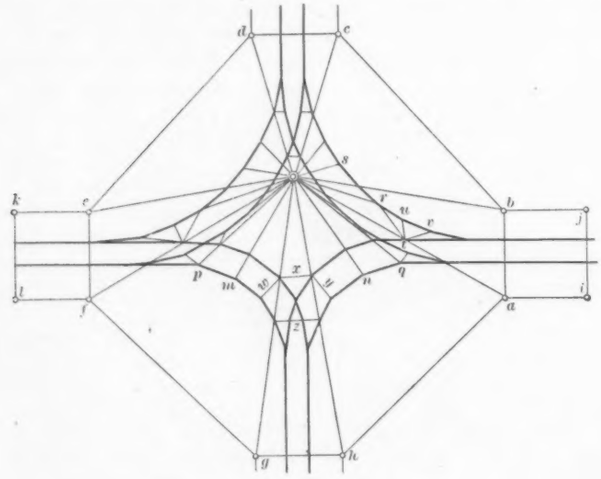


FIG. 2.—PROPOSED TROLLEY WIRING.

c o, d o, etc. Each of these wires is made fast to the ring *o*, which is located a little to one side of the square for a reason which will be stated later. The wires *a b, c d*, etc., are the regular trolley-wire supports, and to relieve the system from any possible side strain which might cause the above-mentioned wires to sag, the tie wires *b c, d e*, etc., were placed as shown, thus preventing absolutely any possible unsupported side strain upon the poles. The feed or trolley wires were attached direct (through the usual insulation) to the wires *a o, b o*, etc., and the other short wires, *m o, n o*, etc., which were placed as the angles between the tangents into which the 90-deg. curves were divided. Other wires, *o p, o q*, etc., were placed as found necessary, then still other wires, *o r, o s*, were connected direct to ring *o*. But several curve angles still remained unsupported, as at *u, v, r*, etc., which were fastened to a convenient angle-point in *a o*, at *t*. Still other parts of the curve-tangents had to be supported by tie-wires, as at *w, x*, and another type of tie-wire was added, as at *z*. Then it was found that every angle into which the feed wire was divided had at its apex a supporting wire which pulled outward in direct ratio to the pull of the feed wire. The writer would be pleased to read criticisms of this lay-out, and to ascertain which wires, if any, could be dispensed with and still leave the installation of ample strength and stiffness.

New York City. James Francis.

TROUBLE WITH A TELEPHONE.

A certain desk telephone set had been complained of for many months. While speech could be heard with distinctness from other instruments, people outside had trouble in understanding what was said through this particular telephone. The trouble man had been to see it several times and could find nothing the matter with it, except that he reported the dry battery useless and replaced it with a couple of new dry cells. This always improved the performance of the telephone for a while, but after a time it would resume its old condition of imperfect enunciation and hard-to-hear speech. Finally, in

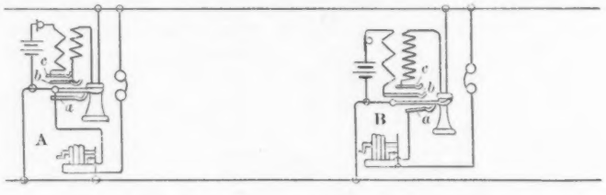


FIG. 1.—DIAGRAM OF TELEPHONE CONNECTIONS.

talking over the matter with the trouble man, who, although quite a young man, had much experience, he casually asked why the dry cells which he placed with that telephone always became wet on the outside in a few months—and sometimes within several weeks, he afterward added. The young man was told that a dry cell would never get wet unless there was a hole in the zinc case which enclosed the cell and which formed one of the elements thereof. The matter of a hole in any of the numerous cells which had been placed with that desk telephone was stoutly denied by the young man, who was presently prevailed upon to bring up the faulty cells and give the writer a look at them. When they came, it was found that not only was there a hole in the case of each cell, but that the entire zinc shell in which each cell was encased had been eaten away by the chemical action developed inside of the cell during its very few weeks of use. There was only one solution possible to this problem; there was a ground somewhere or a short circuit, which had caused a continual flow of current until the cells were almost entirely consumed. The lineman maintained stoutly that there was no short circuit and that the telephone worked perfectly until the cells became wet again, which was within a few weeks. There could be no short circuit or ground, he maintained, as long as the telephone talked well and gave and took call signals properly. Finally, the gentleman was prevailed upon to bring the telephone to my office, and we at once proceeded to investigate. The transmitter was taken off and found to be properly connected. The receiver was also perfect and properly connected into the circuits. The instrument was made for central-energy work, but in use it was supplied with a ringing current (when central did the ringing) from a battery of 65 dry cells operated in series, through a pole changer

which in turn was driven by a single Edison cell. The speaking current for each section of the exchange switchboard was obtained from three gravity cells, in series, and three panels were in use in the little exchange, hence nine gravity cells supplied that department. As stated, two dry cells supplied the speaking current at the instrument, the signaling being done by magneto, the automatic switch of which instrument was so

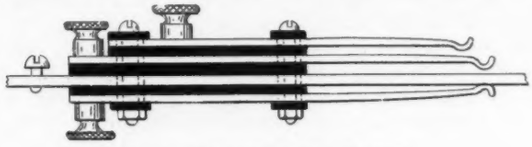


FIG. 2.—OBSCURE SHORT CIRCUIT.

arranged that the magneto was normally short circuited; but the switch opened at the first turn of the magneto crank, bridging the ringing current across the line circuit, through the underneath contact *a*, Fig. 1. The connections were carefully tagged as they were taken down, and the most careful search failed to find anything wrongly connected in the wiring, which was as shown by sketch *A*, Fig. 1. It was observed that the carbon transmitter was in series with the battery which gave trouble, and that when the receiver was off the hook for talking, the dry battery was short circuited through the transmitter, the spring contacts *b* and *c*, and the central spring of the desk set stand which is represented in the diagram by the receiver lever itself. The contact *a*, being the bridge-ringing contact which was broken when the receiver was taken from its hook, thereby cutting out the ringer while talking.

Nothing could be found wrong with any of the connections, as stated, and the instrument was reported all right when the writer observed that there was very little space between the spring contacts *b* and *c*, at *A*. Upon looking at another instrument, as is shown at *B*, much more space was observed between the contacts in question. An adjustment was made of these springs, so that they would remain normally apart when the receiver was on the hook. It was decided that the position described, in which the contacts *b* and *c* had been found, was the cause of the trouble with the telephone, for, with permanent contact between springs *a* and *b*, while the receiver was on the hook, two paths would be provided for the current from the dry cells at the subscriber's instrument. One path would be through the transmitter, the primary and secondary induction coils in series, the line and the ringer coils of the other, which in this case was the central station instrument. The other path was through the transmitter and both coils in series as above, thence across through the ringer coils. Thus the two paths were about equal in resistance, save that of the line, which in this instance was very short. Hence the dry battery was permanently in series with two sets of ringer-coils in multiple. Having found this trouble, the desk telephone was returned to the subscriber with the natural good feeling which comes from solving a problem of this kind, but to the disgust

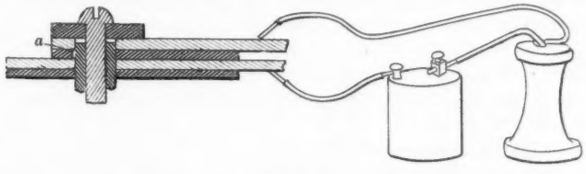


FIG. 3.—TESTING FOR CROSS CONNECTION.

of the trouble man and the writer, the trouble was not remedied by any means, for the battery drain continued. Another desk instrument was substituted at the subscriber's office, and the defective instrument was placed on the operating table for a thorough inspection. Unfortunately, at this point, the defective telephone was returned with a lot of extra material to the main supply room before the cause of the trouble could be learned, but, as luck would have it, the same trouble developed in another instrument, in seemingly exactly the same manner. In this case, there was no trouble with the spring contacts—they were in good shape and proper position, and the trouble was only found after the connections had been unsoldered from the spring contacts and tested out with receiver and battery, for insulation and for good connections. Finally, the desk stand interior was reduced to the condition represented by Fig. 2, all the wires having been unsoldered and the leak remaining under test with the assembly, as shown by the illustration in question. It was thus demonstrated that the trouble must be in the construction of the apparatus, and not in any of the external electrical connections. Fig. 3 shows the manner of testing for electrical contact between the parts of the telephone. A receiver and a dry cell were connected in series and the free ends of the wires applied to the metal parts between which a short circuit was suspected. One or both the wire-ends were dragged across the metal portions while listening at the receiver. When no sound was heard during the movement of the wires over the suspected parts, it was assumed that there was no electrical connection between said parts sufficient to vitiate the insulation. But it was found that noise could be heard in the receiver when the wires were scraped across the two upper springs shown in Fig. 2, but no sound could be heard when any two other parts were thus tested. Fig. 3 shows a section of the springs—or of two of them, down through one of the fastening screws. The dark shaded portions represent the vulcanite insulation, and it is shown that a bit of tube is placed around the screw which fastens the springs together. It was only after the device had been taken down that the cause of the trouble was finally discovered at *a*, where, barely visible among the cross-section lines, is represented a bit of very fine wire which had accidentally got into the hole during the process of assembling the instrument. This wire was even finer than the magnet wire used for winding receiver magnet-coils. In fact, it seemed to have come off of, or out of, the tinsel-like threads of which the flexible cords used for receiver connections are made up. This bit of metal was removed, the instrument reassembled, and there was no more trouble with that desk telephone. The cure was complete and permanent. Twice since, the writer has had similar trouble, and in both these instances, after locating the two members between which it was suspected that a fragmentary metallic circuit existed, a heavy current was turned into the suspected parts and the connection was burned out, leaving the parts so well insulated that the receiver could detect no noise when the parts were scraped with terminals across which 65 volts were maintained. A 110-volt light circuit with a 32-cp lamp was used for burning out the suspected connection. The second time the burning-out method was effected, a ringing current from 65 dry cells was tried. The same current was used for testing with the receiver, then the current from the entire battery was sent through the suspected short circuit. The current was taken from the binding posts of the pole-changer, and it did not interfere with the ringing for more than half a second. The frail connection was evidently burned out in a second, for even when tested with the entire current from 65 cells, no noise could be heard when the contacts moved over the springs shown in Fig. 2.

WILLOUGHBY, OHIO. JAMES F. HOBART.

A NOVEL AND USEFUL TROLLEY LINE.

A certain isolated central station which combines both waterworks and light supply is situated upon the bank of a small river which at certain times is very swift and deep. At all stages of the river, it is necessary for the linemen and the water-men frequently to cross this river in order to care for the intake and a portion of the lamp circuits. A bridge was suspended upon wire cables and did duty for several years, but the comfort of the men and the safety of the bridge were very questionable on windy days. When the wind was blowing a gale, it would get under the flimsy structure and toss it into the air as far as the cables would permit, and the flooring would

be wrenched loose and carried away. So much of the structure was repeatedly carried away by the wind that it was finally decided to abandon the foot-way, and by using the same cables to transform the bridge into a double-track passenger trolley. Fig. 1 gives an idea of the looks of the apparatus after the change was made. The same cables and the same four poles were used, also the same anchorages, and approaches, with the

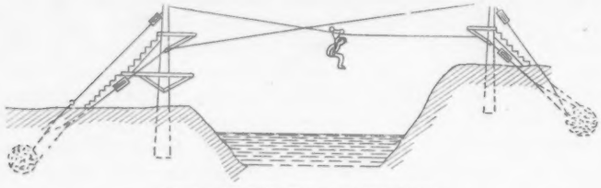
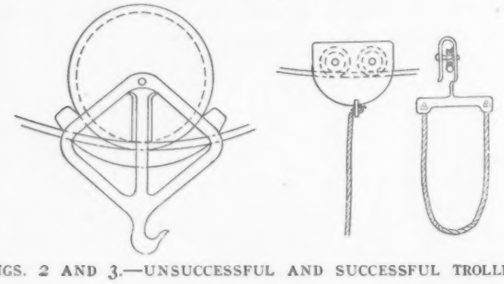


FIG. 1.—SKETCH OF TROLLEY.

addition of one on one side of the river, where the ground served as a landing stage. Originally, both the cables were made fast to the poles and level with the top of the stairs. Had the poles been tall enough to permit the raising of one end of each cable above the landing, then the cables could have been left with the landings as they were originally placed. But it was found necessary to lower one end of each cable, as well as to raise the other end, in order to secure the necessary drop, which was found to be 1 ft. to each 14 ft. span. By placing the landing end of each cable under the starting stage, there was no interference of trolley or landing stage. A little difficulty was experienced when the trolleys were first rigged up, and the arrangement shown by Fig. 2 proved a complete failure. The movement of the passenger seemed to throw a good deal of pressure against the flanges of the sheave, and the first thing the passenger knew, he had lost headway and was suspended between starting and landing places. He then had to pull himself along the cable, hand over hand. Next, a tandem pair of wheels was rigged, as shown by Fig. 3—a couple of trolley wheels from a street railway shop being pressed into service, and a housing was made for them of 3-16-in. plate which was bent up as shown; the parts to receive the rope swing being simply turned at right angles to the body of the carrier. The most comfortable way to travel in this vehicle is to sit down in the swing, as shown in Fig. 1; but the passenger can place one or both feet in the swing and stand if he chooses. His head will then be above the trolley cable, which position may be of advantage if looking for trouble, as is often the case when using a trolley, as shown in Fig. 4. The latter illustration



FIGS. 2 AND 3.—UNSUCCESSFUL AND SUCCESSFUL TROLLEY.

represents the poles of a long aerial transportation system fitted with the double-sliding trolley as a means of getting quickly from one pole to another, something which has to be done quite frequently when there are a pair of pulleys to be oiled and kept in good condition on the top of each of the poles, some of which are 80 to 90 ft. above ground, and, as shown by the engraving, sometimes very rough ground, too.

The writer can bring to mind, and the reader will also think of many instances, where an arrangement of this kind would be of great value for crossing torrents, chasms, and for even passing from one portion of a large building to another. Even for the oiler, who must visit difficult places, a trolley line of this character, modified to suit the conditions, would prove of great value. An arrangement of this kind rigged from the top of a battery of boilers to a distant part of the factory or station would prove a most welcome means of escape when it is required to close the stop-valves on top of the boiler in case of accident to the other valves, or to the pipe line through the station. The writer has seen the time when it was impossible to get away fast enough from the cloud of hot steam. In arranging this trolley for passage in either direction, it is necessary that the cables be separated a distance greater than the length of the cross arm of the traveler. This is to prevent two passengers from colliding when they are passing each other. When the travel is in one direction only, of course this precaution is unnecessary. When erecting a new line, it is easy to hang both cables to the same pole by simply inclining the pole so that the cables and consequently the carriers or travelers will hang clear of each other. Were this to be done with the line pictured in Fig. 1, the poles must stand at a sidewise angle of 2 ft. in each 5 ft. of height. This would call for another dead-man anchorage at right angles to the line, and it would also call for the inclination of alternate poles in the opposite direction all along the line. Some kind of hand-propelling apparatus will be necessary when this line is to be used for repairs and inspection, for upon stopping near the landing end of the line, some convenient form of grip must be

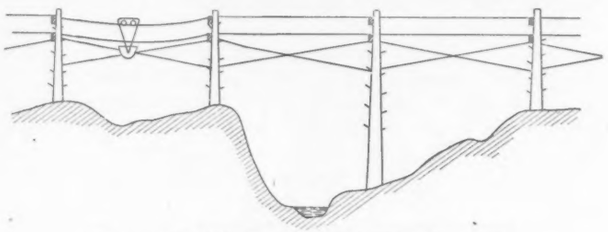


FIG. 4.—TROLLEY AUXILIARY TO CONVEYOR LINE.

attached to the end of a short rod for the purpose of pulling one's self along after stopping midway between stations. A flat U-shaped forging attached to the end of a small rod or a stick would prove all that is necessary, if so arranged that pushing or pulling on the rod would cramp the U-shaped forging against the cable.

NEWCOMERSTOWN, OHIO. FREDERICK J. HAINES.

CARE OF GAGE GLASSES.

In the boiler-room, the gage glass very often receives but scant attention. When one breaks every engineer knows it is not a very comfortable matter to shut the valves leading to the glass and replace it. Spare glasses should always be kept on hand for just such emergencies and in the keeping of these spare glasses some care is called for. For instance, it is very common to find spare glasses strung upon a wire, and unless a soft wire like copper be used, the glass, if moved much, is sure to be scratched by the wire which leads to its early breakage. It is singular how sensitive the inner surface of a gage glass is to injury of this sort, the slight friction of an iron or steel wire being sufficient to cause the glass to break from apparently no cause whatever. The experiment may be tried any time by rubbing the inner surface of a gage glass with an iron wire and then placing the gage glass carefully away. In a great majority of cases it will be found that if the glass has not broken spontaneously in the course of time, its life, when in service, will be very short. Another fault to be found with gage glasses in boiler-rooms is that they are set in such poor shape and so ill lighted that proper care is seldom vouchsafed to them. It is an easy matter to place an incandescent lamp near the gage so that it may be readily seen at all times; but too often nothing of the sort is provided and the gage cannot be read with ease. This, coupled with the dirty conditions in the boiler-room, soon obscures water in the glass altogether so that it is a very easy matter for the fireman to make a mistake which may prove costly. If a gage glass breaks the fireman can bind up his arm and hand and close the lower valve without danger.

BIRMINGHAM, ALA. CHESTER ADAMS.

QUESTIONS AND ANSWERS

Is the apparatus used for vacuum cleaning, and run by a motor, a pump or a fan? S. M. G.

There are numerous vacuum cleaning devices on the market which in their make-up call for fans, pumps, bellows or other means for exhausting the air. Many of the portable devices consist of small fans properly protected from dust, and which create a vacuum at the sweeper tool.

How accurate are ammeters on alternating current circuits? C. R. T.

Ammeters for these circuits are usually of the iron vane type and possess an error less than ½ per cent due to variation in wave form. If used in connection with series transformers other errors are introduced, and these increase as the impedance of the secondary circuit of the transformer increases and as the primary current diminishes.

Which is the preferable method for exciting the field coils of boosters? L. C.

A booster should be provided with separate excitation of the field magnet. Separate excitation makes the magnetism of the machine more stable and is in any case much to be preferred for machines where the voltage must be regulated down to a very low value. A shunt machine can only be regulated down to about one-third normal voltage; for from this point downward the voltage becomes unstable and the machine is inclined to lose voltage altogether. With separate excitation this is completely prevented. For this reason it is best to excite the booster from the main generator or from the battery.

Wherein does the three-wire dynamo of Dobrowolsky differ from the three-wire machine usually credited to Lamme? B. W. H.

In the Dobrowolsky three-wire dynamo, a choke coil is tapped into the armature windings at the two points opposite potential, if the dynamo is a bipolar machine, and the center of this coil is connected to the neutral wire. If the choke coil is mounted so as to rotate with the armature, the neutral is connected to the center of this coil by means of one slip-ring. If the choke coil is mounted in a stationary position, the outside terminals of the coil are connected to the armature through the medium of two slip-rings, and the neutral connection is tapped in solid. The center of the choke coil is at mid-potential, and any difference in current between the two branches of the system can flow along the neutral and through the coil, which offers no impedance to direct current. The windings of the choke coil are arranged so that all direct currents in the coil are magnetically opposed, thus avoiding saturation of the core. An alternating magnetizing current, and also an alternating core-loss current, are present in the coil, however, and both these currents increase with unbalanced load, because it is not possible to eliminate completely the unidirectional magnetization. In the Lamme modification of this invention the slip-ring connection is two-phase; that is, there are four slip-rings outside the commutator, and two choke coils connected in star. The neutral wire is connected to the center of this star, so that a slight gain is made in the distance the neutral current must traverse the armature winding.

Are there any rules governing the installation of suction gas producers? C. F. M.

The Board of Fire Underwriters will permit the installation of a suction gas producer of approved make having a maximum rating not exceeding 250 hp inside a building, provided the apparatus for producing and preparing the gas is installed in a separate, enclosed, well-ventilated fireproof room, with standard fire doors at all communicating openings. The installation of a producer in cellars, basements or other places where artificial light will be necessary for their operation is considered hazardous, and will not be permitted except by special permission of the underwriters having jurisdiction. When the plant is not in operation connection between the generator and the scrubber must be closed, and the connection between the producer and the vent pipe opened, so that the products of the combustion can be carried into the open air. This must be accomplished by means of a mechanical arrangement, which will prevent one operation without the other. If illuminating or other gas is used as an alternative supply, the connections must be so arranged as to make the mixing of the two gases, or the use of both at the same time, impossible. The opening for admitting fuel must be provided with some charging device, so that no considerable quantity of air can be admitted while charging. The smoke and vent pipes shall, where practicable, be carried above the roof of the building in which the apparatus is used. Such pipes must not pass through floors, roofs or partitions, or under any circumstances be connected into chimneys or flues.

Are there any devices on the market for testing transformers in service which have broken down for any reason and which defect is not indicated by interference of service conditions? Transformers sometimes break down due to lightning or electrostatic strains or to normal depreciation and may become a menace. F. G. G.

We understand that a line-testing outfit which can be used for testing transformers connected in service, without the necessity of removing or replacing them from the primary lines, was devised by the superintendent of the Louisville (Ky.) lighting company. The outfit consists of a choke coil of high resistance, which is secured in a case. Partially surrounding this coil is a movable core of soft-iron laminations and the terminals of the coil are connected to two single-pole fuse blocks placed on the outside of the case. In testing the transformer, the circuit on the secondary is opened by pulling the main switch near the entrance of the building supplied or by removing the fuses from the main secondary cut-outs. The free end of one fuse block on the testing set is connected to one side of the primary supplying the transformer and the free end of the other fuse block is connected to the secondary. If there is a dead short or cross between the primary and secondary coils, the fuses will blow. If the fuses do not blow, it indicates that the insulation between the primary and secondary is satisfactory, having withstood the normal voltage of the line. A similar test should also be made between one side of the primary as connected and the case of the transformer. The connection of the testing outfit is then changed to the other side of the primary supplying the transformer, and the same tests as above repeated. The complete test requires only a few minutes and can be made with convenience and safety.

What general rules should cover the installation of synchronous motors to increase the power factor? F. P. R.

Power factor correction by synchronous motors is obtained most economically when a mechanical load is available for the motor. The more mechanical power that synchronous motors give out, in addition to furnishing leading current, the more efficient is the installation. Ordinarily it may not be found profitable to raise the power factor by the use of synchronous motors to values higher than 90 per cent to 95 per cent. Synchronous motors should only be installed where they are adapted to the mechanical load available, and where they will receive intelligent care. Power factor regulation secured by the use of these machines is not automatic, but depends on the adjustment of the field current. Improper adjustment, lack of attention, etc., may offset all the advantages derived from the use of such a machine, and might, under certain conditions, even lower the power factor. If induction motors are replaced by synchronous motors, the change should be made on the larger sizes, so as to reduce the number of synchronous motors required. Induction motors take a constant magnetizing current from the circuit as long as the voltage is constant, independent of the energy load. This is usually considered the total wattless component, neglecting leakage, and the ratio of this magnetizing component to the rating of the apparatus is reasonably constant. In induction motors this magnetizing component in kilovolt-amperes is approximately 30 per cent of the horse-power rating of the motor. For example, if there is a connected load of 1000 hp in induction motors, the constant wattless component of the induction motor will be 300kv-amp. This gives a convenient approximate means for estimating the wattless component and the consequent synchronous condenser rating.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Tungsten Installation Results.

In the current issue of the *Bulletin* of the Denver N. E. L. A. Section, Mr. C. F. Oehlmann gives the following summary of results from complete tungsten lighting installations. The figures apply to the first 11 consumers that adopted tungsten lamps. In most cases the change to tungstens was made by the consumer not only to get better light, but to reduce his light bill. In one case, the customer in making the change declared that if it did not reduce his bill very materially, he would put in a gasoline plant.

The revenue from the old installation was as follows: Electric, interior alone, $1,951.15; electric, including flat rates, $4,282.60. Gas, both light and fuel, $946.80. Total revenue received, $5,229.40. Under the new installations for the past seven months the electric is $2,949.40; electric, including flat rates, $4,848.40, and gas, $667.45. Total revenue received, $5,525.85, showing a gain of $998.25 on the electric and a gain of $565.80 on the electric including flat rates. There was a loss on gas of $268.45, making a total gain of all revenue received of $296.45.

This gain of $296.45 on the 11 consumers for seven months appears to be very good, when one considers that most of these people were dissatisfied with, and endeavoring in some way to cut their electric and gas bills.

Coal Consumption in Small Stations.

Although small central stations operating with high-speed, simple, automatic cut-off steam engines are more numerous than any other class, probably less is known about their actual coal consumption per kw-hour than about that of larger and more economical stations. Stations of the small high-speed engine class which employ watt-hour meters for measuring the total output and keep actual records of coal consumption are the exception. Frequently also these stations, even though provided with total output meters, are carrying steam-heating or ice business, which makes it impossible to separate the coal required for electrical operation from that required for other purposes. Nevertheless, we have obtained a few figures recently from the stations operating simple, high-speed engine units of less than 200 hp. They are instructive as showing what fairly well-maintained small plants are doing.

One of these plants, in southeastern Missouri, uses southern Illinois slack from the Carterville district, which is a coal of good heating value. In this plant the consumption of coal is 10 lb. per kw-hour, covering everything in the operation of the plant for a considerable period. In another plant located in southwestern Illinois, using Hillsboro slack, special tests for 24-hour periods have shown a consumption of 9 lb. to 10 lb. per kw-hour. In another plant in southern Illinois, burning Centralia slack of low grade, the consumption is 14 lb. per kw-hour. All of these plants are well maintained, but nearly all operate engines considerably under-loaded during much of the day.

Average Consumption for Different Classes of Lighting.

The *Bulletin* of the Denver N. E. L. A. Section gives the following data of the annual kw-hour consumption of different classes of electric light customers. The data are given on the basis of 16-cp carbon-filament lamps consuming 4 watts per candle-power. To obtain the data a representative installation of each one of the classes was selected, the consumption for 12 months was taken from the ledger and the actual equivalent candle-power installed was counted. The number of consumers of each class was then multiplied by the average thus determined to get the total consumption for that class and total number of lamps connected. From these averages the final averages for the consumption per 16-cp lamp for the nine general classes of consumers were derived.

	Kw-hours per year.
Dwelling places	52.0
Offices, etc.	154.5
Manufacturing industries	62.0
Places of amusement, etc.	139.8
Public buildings, repair shops, etc.	54.7
Saloons, etc.	226.6
Wholesale establishments	80.8
Retail establishments	111.3
Miscellaneous	23.1
Average	71.2

Economy of Tungsten Lamps.

By V. L. Hollister.

The central-station man in the small town is often asked about tungsten lamps: What do they cost? Will the monthly bill for light be reduced?

The usual answer given is: "With a tungsten lamp you can obtain more light per lamp than you get from the ordinary lamp and at a cost per hour of less than half." This is true; but the customer may be from Missouri. To meet the demands of the situation the following table has been compiled for a small central station where the minimum rate is 75 cents per month. Column one gives the number of lamps burning for an assumed schedule as given of 2 hours per night or 60 hours per month. Thus, the last figure being 20, 20 lamps burning 60 hours per month would yield a monthly light bill for the 60-watt carbon lamp of

$$\frac{20 \times 60 \times \$0.15 \times \text{watts per lamp}}{1000} = \$10.80.$$

The present market price of tungsten lamps is given and it should be very easy to demonstrate, even to a Missourian, that the tungsten lamp with its higher first cost is the cheapest to buy and operate.

TABLE SHOWING COST PER MONTH TO OPERATE VARIOUS LAMPS. LAMPS TO BURN 2 HOURS PER NIGHT, 60 HOURS PER MONTH. METER RATE, 15 CENTS PER KW-HOUR.

Number of lamps burning.	Tungsten			Carbon
	20 cp.	32 cp.	48 cp.	16 cp.
1.	$0.75	$0.75	$0.75	$0.75
2.	.75	.75	1.35	1.35
3.	.75	1.08	1.89	1.89
4.	.90	1.44	2.16	2.16
5.	1.13	1.80	2.70	2.70
6.	1.35	2.16	3.26	3.26
7.	1.58	2.52	3.78	3.78
8.	1.80	2.88	4.32	4.32
9.	2.03	3.24	4.86	4.86
10.	2.25	3.60	5.40	5.40
11.	2.48	3.96	5.94	5.94
12.	2.71	4.32	6.48	6.48
15.	3.48	5.40	8.10	8.10
20.	4.52	7.20	10.80	10.80

When operated as above the lamps will have a life of approximately 18 months.

PRESENT COST OF TUNGSTEN LAMPS.

20 cp	$0.85
32 cp	1.10
48 cp	1.40

PRESENT COST OF CARBON LAMPS.

16 cp	$0.20
32 cp	.30

To illustrate the use of the table, drop down to the figure 10 in column one and note—

10 20-cp tungsten lamps cost on this schedule	$2.25
10 32-cp tungsten lamps cost on this schedule	3.60
10 48-cp tungsten lamps cost on this schedule	5.40
10 16-cp carbon lamps cost on this schedule	5.40

A 20-cp tungsten gives four times more light than a 16-cp carbon lamp and costs but 22½ cents to operate for one month at the rate and schedule given above when the 16-cp carbon lamp costs 54 cents to burn for the same period.

The Detroit Residence Rate System.

A system of rates for residence consumers employed by the Detroit Edison Company for several years is beginning to find favor with several smaller companies and has certain features of interest to which but little attention has been called in articles and discussions on the rate question. The Detroit plan is to charge 16 cents per kw-hour up to a point where the customer's consumption equals 2 kw-hours per month for each of the rooms in the house, which are counted, and 4 cents per kw-hour for all electricity used in excess of that amount. The characteristic or peculiar feature of this system is that it is based on the theory that a consumer's maximum demand is in proportion to the number of rooms in the house rather than in proportion to the number of lamps actually connected. In determining the amount which must be used before the lower rate is secured by the Detroit system, only the principal rooms of a house are counted. Two kw-hours per month is the equivalent of 60 hours' use per month of 33 watts per room or 30 hours' use per month of 66 watts per room counted. As a basis for the rate all of the rooms of the house are included except the kitchen, laundry, storeroom and three bedrooms. The same system has been adopted by the Jefferson City (Mo.) Light, Heat & Power Company.

The Lawrenceville Light & Water Company, Lawrenceville, Ill., on June 1, 1908, adopted a residence rate system based on the same principle, but differing somewhat as to the method of counting. The Lawrenceville plan is to multiply the number of rooms counted by 1200 watt-hours. This gives an amount which is billed at the rate of 15 cents per kw-hour. Electricity in excess of this amount and up to 2400 watt-hours per room counted per month is billed at 6 cents per kw-hour. All in excess of 2400 watt-hours per month per room counted is billed at 5 cents per kw-hour. Consumers are given the option between this rate and a straight 10-cent per kw-hour rate. Heating appliances and flatirons are not counted as influencing the maximum demand. The practical effect of this is to give a low rate to non-peak business, such as flatirons, and to favor the residence consumer using electricity many hours per day. The majority of the resident consumers are on this rate. The portion charged at the high rate is equivalent to 30 hours' use per month of a maximum demand of 40 watts per room counted. The method of counting rooms is somewhat different from that at Detroit. All of the rooms of the house are counted, except bathrooms, basement, porches, stairways, attic, storerooms, small halls, entrances, woodsheds and barns. The rooms counted are, therefore, the regularly occupied rooms of the house.

It is now generally accepted that an equitable system of charging is one based on the consumer's maximum demand and that the average rate per kw-hour which he pays must be dependent upon the number of hours that maximum demand is used per year. It is the maximum demand which determines the investment which must be put in by the company to serve the consumer. Aside from the Detroit system, there have been two methods extensively employed for determining the consumer's maximum demand as a basis for charging. The most common system has been to assume that this maximum demand is a certain per cent, say, about 40 per cent, of the total connected load in the residence. An objection offered to this plan is that it puts a penalty on the use of numerous very convenient lamps in closets and other places where they are turned on but a very few moments at a time and which really have very little influence on the consumer's maximum demand. It is not desirable that a consumer be virtually obliged to pay a higher rate per kw-hour simply because he has these conveniences, because it restricts their use and cuts down the total consumption of energy.

The other method of counting the maximum demand has been to install a maximum-demand meter, but the expense of such meters has prevented the extensive use of this method among small residence consumers, although it is in use in a few large cities. It is, of course, more accurate than any assumed figures.

The advantage claimed for the Detroit system is that it does not put an unjust penalty on the use of as many convenient sockets as the consumer desires. It is based on the broad assumption that the consumer's maximum demand is approximately proportional to the number of regularly occupied rooms in the house. The argument against it is sometimes advanced that in some houses with very large rooms the number of lamps per room is greater than in a small house. While this is true, on the other hand, the large house is likely to have more of its rooms unoccupied at one time than is the small house. This tends to keep the ratio of maximum demand to rooms about the same for the different houses.

Value of Electrical Association to the Industry.

BY H. W. HILLMAN.

In the histories of the arts there is no more interesting study than that which has to do with the electrical industry. By leaps and bounds its various branches have been advanced to a degree which has made the electrical industry at least more interesting, if not more important, than all the others. During the past quarter-century electrical students have accomplished feats of engineering which have placed them foremost among the greatest engineers which the country has known. When we think of the development of the electric street railway, we marvel at the wonderful extension of this branch of the industry since 1887, a period of but 22 years.

It has been particularly noticeable how rapidly advances have been made in the electrical arts. One reason for such quick results from the factory to the consumer lies in the activity of the electrical associations, and perhaps we do not appreciate the value of these associations. One of the most conspicuous State associations was that organized in Ohio during the early years of the history of the industry. The writer entertains fond recollections of the Ohio State conventions which he attended in 1896 and 1897. The association at that time had quite a good membership, and every active central-station man would save his time during the year to be sure to have a full week for the Ohio State convention in August.

Manufacturers and supply dealers appreciated the value of such gatherings, and were always glad to exhibit new devices at such times, and sent the best men available as an indication of their interest in such meetings. About the time mentioned the series-alternating system of street lighting was receiving marked attention. The Ohio State association was one of the first to devote time and energy to the study of its merits. As a result, the greatest numbers of alternating street lighting systems were installed among the cities and towns of Ohio.

Then the small-motor business became prominent, and at the earliest moment that the factory engineers could say that designs were ready for the consumer, the officers of the Ohio State Association found ways and means for accurately informing its members regarding their merits. How wise it now seems that such close attention was given to the subject, because the years which have since passed have been filled with new ideas and extensions of designs which never could have been advanced so rapidly had it not been for the activity of the Ohio and other kindred associations.

A vast amount of credit is due the National Electric Light Association for its aggressiveness and its continual activity in the field. When Mr. Henry L. Doherty introduced such drastic measures for increasing the membership of that association one did not realize how valuable it would be to the industry in the years of 1906, 1907 and 1908. It seems to have been just the thing to do exactly as he did, because later, when the ideas of the Co-operative Development Association were promulgated through the channels of that association the information was spread broadcast and its ideas were quickly acted upon by the members of that association, the real life of the electrical industry, and great was the benefit therefrom.

Early in the development of the steam turbine work, the

National Electric Light Association appointed a turbine committee whose energies and activities led to a remarkable change in central-station equipment, wonderful changes and results being secured in a marvelously short period.

In late years there has been hardly a meeting of the National Association which has not included a paper or discussion from some famous engineer representing a central station from some foreign country, and frequently there have been several members who have returned from Europe particularly to attend the convention and favor the other members with their experiences, which have always been interesting and valuable. Is it any wonder that the industry has advanced so rapidly when one considers such organization, such facilities, and such close relationship between manufacturers and kindred associations?

My experience as president of the Michigan Electric Association has led me heartily to indorse electrical associations. It is quite evident that the central-station people of Michigan believe in them when one considers that the membership of the Michigan Association was considerably more than doubled during the year 1908. For three days of each year the members come together and vie with each other in setting forth the latest and most up-to-date methods adopted in handling the various branches of the business; always endeavoring to impart information which will be helpful to other members in the conduct of their business. In this respect the Michigan Electric Association is a highly co-operative and beneficial organization.

At the last meeting the association was favored with the presence of Dr. Steinmetz, who remained for two days, taking part in the discussions and adding greatly to the interest of the convention. On one of the evenings he presented the subject of "Lightning Phenomena" before the association in a manner that was keenly enjoyed. This lecture was not only of much benefit to the association, but also to the power company of Grand Rapids. Several hundred of its prominent customers were invited to attend; the occasion was generally enjoyed, particularly by the members of the association, and was very instructive.

The association was favored, also, by the presence of Mr. Alex. Dow, of Detroit, who entered into the discussions of the proceedings in a way which added keen interest and value to the meetings. As past-president of one of the most famous electrical associations which this country has ever known, and as a most prominent electrical man of the State of Michigan, the association felt grateful for his presence and interest.

The association was also favored by the presence of Mr. J. R. Cravath, associate editor of the *Electrical World* at Chicago. His past tests and knowledge of electrical heating devices benefited us when discussing these subjects, but the greatest help of all was his presence and the manner in which our discussions and proceedings were set forth later in the *Electrical World*. We soon commenced to appreciate that we were not only a local State body, but a part of the great electrical fraternity, destined to help build up this vast industry shoulder to shoulder with other State associations; hand in hand with the great National Electric Light Association; always appreciating the efforts of the dignified but famous Association of Edison Illuminating Companies and thankful for the efforts and interest of the electric manufacturers and supply men actively engaged in the work which we are all pledged to promote.

The writer emphasizes these points because it is the association itself which has brought about such co-operation and harmony between individuals interested in the entire industry. Therefore, let us cherish electrical associations, and as we approach another season when plans are being made for more meetings of each organization, let us one and all try to arrange to attend. Let us cheerfully interest ourselves in the promotion of the good work being done by the associations whose officers and committees are giving of their time and substance to make the meetings interesting and valuable to the members.

Central Station Methods of Selling Electrical Devices for Domestic Purposes at St. Louis.

By W. H. Wissing.

When the company with which the writer is connected became convinced that electrical devices were not experimental, but were practical and economical in operation, in addition to possessing advantages over other apparatus designed to do work of similar character using coal or gas, it determined to get them on its lines at once, but by methods, the fundamentals of which should never conflict with the sound business principles governing the introduction and sale of other necessities, to the public by commercial houses.

Conceding the value of these devices as factors tending to increase the day load at hours when the central station can best afford to furnish it, and fully realizing the importance of selling as many of them as possible, in the shortest space of time, to improve the income from residential sources, a campaign was planned upon lines which, in the company's judgment, would result not only in getting them out quickly, but with a margin of profit from their sale that would enable it to make them stick and be conducive to the sale of more of them.

A FREE TRIAL AT YOUR HOME.

Any of the articles listed below will be delivered to you by wagon, for trial, during the period indicated opposite each item, without charge for delivery, trial or return.

ARTICLE	Size, Style, Weight	Catalogue No.	Selling Price	Terms of Payment After Trial and Acceptance: Cash with Confirming Order	With First Monthly Bill for Current	Monthly Thereafter Until Paid	At Your Disposal For
Smoothing Iron	Nickel 3 lbs.	38,124	$5.00		$2.00	$1.50	30 Days
" "	Aluminum. 6 "	36,815	6.00		2.00	2.00	30 "
" "	Gun Metal. 6 "	75,120	6.25		2.25	2.00	30 "
" "	Nickel 6 "	75,115	6.25		2.25	2.00	15 "
" "	Aluminum. 8 "	75,126	7.00		3.00	2.00	15 "
" "	Gun Metal. 8 "	75,135	7.25		3.25	2.00	15 "
" "	Nickel 8 "	75,130	7.25		3.25	2.00	15 "
Tailors' Iron	" 12 "	45,321	12.00		4.00	4.00	10 "
" "	" 15 "	47,357	12.75		4.75	4.00	10 "
" "	" 18 "	47,362	14.00		6.00	4.00	10 "
" "	" 24 "	47,367	15.00		6.50	4.25	10 "
*Curling Iron Heater	Nickel	1,274	3.00		1.50	1.50	10 "
* " "	Polished Brass	1,275	3.25		2.00	1.25	10 "
Shaving Mugs		44,303	3.00		2.00	1.00	10 "
Corn Poppers		45,028	5.75		2.75	1.50	10 "
Toasters		1,710	5.00		3.00	2.00	5 "
Disc Stoves	6-inch	38,651	6.00		2.00	2.00	5 "
" "	8 "	38,652	11.25		4.25	3.50	5 "
" "	10 "	38,653	14.50		5.50	4.50	5 "
Traveler's Stove	One-half Pint	1,710	5.00		2.50	2.50	5 "
Cigar Lighter	Table	75,234	2.75		2.75		5 "
" "	Pendant	39,523	2.75		2.75		5 "
Foot Warmers	9" x 10"	1,371	5.00		2.50	2.50	5 "
" "	9" x 12"	1,375	7.50		3.75	3.75	5 "
Hair Dryers			35.00	$13.00	11.00	11.00	5 "
Vibrators			35.00	13.00	11.00	11.00	5 "
French Hat Irons		1,527	6.00		2.00	2.00	5 "
Washing Machine	1900		$55.00	25.00	15.00	15.00	5 "
" "	Steiner's	No. 2	60.00	30.00	15.00	15.00	5 "
Mission Portables		223	3.00		1.50	1.50	5 Days
Sunlight Portables		655½	4.00		2.00	2.00	5 "
Extension Portables		21*	3.75		2.00	1.75	5 "
Turn Down Lamp	4' Cords		1.25		1.25		5 "
" " "	6' "		1.50		1.50		5 "
" " "	8' "		1.65		1.65		5 "
" " "	10' "		1.75		1.75		5 "
Water Bag Heater	Standard		2.00		2.00		5 Days
Luminous Radiator	Portable Oxidized	42,177	18.50		8.50	5.00	5 Days
Tubular Air Heaters	Floor Type	75,210	14.50		5.50	4.50	5 "
" " "	Wall "	75,265	15.50		6.50	4.50	5 "

LIST OF HEATING DEVICES AND RATES OF PAYMENT.

The popular or common method of loaning irons was immediately put into effect, with modifications or amplifications, of the general plan employed in other cities. The irons were loaned for 30 days, with the stipulation that if, at the termination of the trial, the customer was entirely satisfied with their performance, they would retain them, paying $6 for irons up to 6 lb. in weight, without deviation from this figure to any customer under any pretext.

This price was maintained (it still holds) while some of the department stores were selling some other iron at $3.98 or less, but with no specific guarantee. The latter were not equipped to repair or maintain electrical devices; when they went wrong and out of commission, purchasers needing repairs to their irons were referred to their local electrician, and must needs wait until the damaged part could be gotten from the manufacturer, and then pay (even if a very small margin of profit be added) a price for the repairs usually more than enough

to wipe out the difference between the original purchase price and our $6 charge.

The Union Electric Light & Power Company determined to see to it that these desirable and convenient devices should win recognition on their merits. It determined, also, that there should enter into their introduction to the public not the slightest element of chance or speculation on the part of the purchaser. It prepared at once to assume all responsibility, to get squarely behind them, and to permit no quibbling in exchanging defective or ineffective apparatus for new or other devices better suited to the customers' needs.

In this lies the warrant and justification for asking prices that, while neither exorbitant or prohibitive, hold a sufficient margin of profit to enable the company to make guarantees that would at once establish and maintain an ever-increasing degree of confidence in them not possible otherwise without loss.

In connection with the iron, the guarantee is practically perpetual. It reads thus: "Thereafter your company is to renew, without charge to me, such parts of the 3 and 6 lb. irons (excepting the iron bodies) as may prove defective, if the iron has been used exclusively on your electric service." The company lives up to the letter and the spirit of this guarantee, even in the face of evident discord at home, in which the iron sometimes appears to have played a leading part.

This very broad guarantee covers in its printed matter the 3 and 6 lb. irons only, but its spirit and import applies to the entire line of devices: the disposition always is to take the customer's view of his troubles and help him out in the same degree that he feels justified in paying the lighting company a trifle more for an article that he is assured by its guarantee will not, if it meets with a mishap, cost him for repairs something approaching the price he would be compelled to pay for one not thus protected.

To obtain the best possible results from this arrangement, the company is careful that apparatus is not sold for any purpose for which it is not well designed. It is especially insistent that the prospective customer shall know what it will cost him to operate the device he may purchase, giving him the limit always. It has frequently declined to loan articles for trial where it knew that the first month's bills would bring back with it the device with its reputation irretrievably blasted in the estimation of its user.

The luminous radiator is an excellent instance of what it is best not to sell except for the purpose it was designed to serve; yet the company has sold several hundred of them. It begins with the warning that the 750-watt radiator will cost (at residential rates, 12 cts.) 9 cts. an hour to operate, and the 1500-watt 18 cts. an hour; that to attempt to use it for general heating is at present absurd, but that for temporary use in the morning while dressing, for additional heat in the bathroom or nursery, it is ideal and not expensive. The customer thus prepared does not come back with complaints about excessive operating costs. He uses them for the purpose intended, likes them, and commends them to others.

The reference to the department store was in no sense intended as in disparagement of them. As mediums for the quick introduction of any new thing they are unequaled. They are in daily contact with thousands who are there to purchase, while those who come to the company usually come to pay. The mental attitude is, therefore, different and much in their favor, but the company holds, in connection with electrical devices, that until they have become standardized, with repair parts as easily obtainable and replaced as other household apparatus, that they should be handled exclusively by central stations or dealers as agents, backed by the manufacturers, who will make it their special business to guard the purchaser against acquiring apparatus not suited to his requirements, and that when they do sell, the apparatus shall represent thereafter the absolute maximum of convenience with a minimum of trouble and expense. You cannot maintain this position at $3.98 per.

A year or so ago, a young man of modest appearance and address came to our show room and, somewhat diffidently inquiring the price of a coffee percolater, said that as soon as he could afford it he would purchase one. It developed that he had a chafing dish and a 6-in. disk stove, and that his wife, who was his cook as well, found them so convenient and inexpensive to use that they were saving up for the next addition—the percolator. He was asked if he cared to purchase one at once, and pay for it in several installments. He did. The company immediately got busy with the installment plan, evolving the schedule on the preceding page, which it recommends highly, with the rest, as an additional inducement to customers to add gradually to their stock of electric devices.

In its experience, in developing this class of business it has found the best market among those who do some or all of their own work. Nearly 75 washing machines at $55 each, paid for "on time," are in use on its lines, saving their original cost and $20 to spare every year, counting the cost of a wash woman at $1.50 per week "and found" as saved by the use of them.

A word as to the method of keeping track of repairs, renewals, exchanges, etc., in this connection. It is simple, easy and effective, especially in cases where devices come back too often, and works as a check on the careless. A set of blank forms is kept as follows:

When a trial is desired by a customer, Form No. 1 must be signed and sent in. Form No. 2 is the receipt for the article and is attached to Form No. 1, completing the transaction until trial is finished. Form No. 3, "Confirming Order," is signed, and with Form No. 2 is attached to Form No. 1 and charged up, all being placed in an envelope with customer's name and address.

If madame's iron or curling tongs get out of order, she does not hesitate to apprise the company of the fact, which sends for it, using Form No. 4, which is an order on her to deliver it. When it is repaired, it goes back to her on Form No. 2, her second receipt showing what was done to it and marked *no charge*. If this is repeated too often, the company reminds her courteously that on the different dates shown by her receipts it made repairs, the nature of which indicated harsh usage, and that while it would continue to keep it going, there are limits beyond which good irons and tongs are not useful, etc.

It contends, in conclusion, that the ideal way to introduce electrical devices is to charge for them a price that will enable one to *maintain them;* that in doing this, each of them is made a valuable selling agent for others; that the cost of this method represents a goodly profit left after all repairs, exchanges, etc., have been deducted; that selling electrical devices is not an advertising stunt, but a cold, legitimate business proposition, based upon commercial common sense that will make "both ends meet" and overlap; that giving away good, honest, serviceable and popular necessities is a crime with no excuse to support it; and as proof that these deductions are correct and that it is indulging in no fantastic dream, the company has a record of nearly 4000 families using these devices with entire satisfaction and no complaint either as to the price they paid for them or the manner in which they are cared for.

Business conducted upon business principles will win out always. If this paper will serve the purpose of checking the reckless sacrifice of articles that have merit and value far beyond those operated in the old way, it will be worth while.

Methods of Building Up a Day Load in Small Central Stations.

At the recent Minnesota Electrical Association convention at Minneapolis one session was given to papers and discussions on development of a day load in small central stations. Mr. Adolph Wagner, superintendent of the municipal plant at New Ulm, Minn., gave a paper on the general subject. He expressed the opinion that except where unusual local conditions prevail, day service can be established profitably in any town of 1000 inhabitants or more. If the proposition is taken up in a half-hearted manner it is not likely to succeed. On the other hand, it should not be expected that a service started to-day will

be on a paying basis to-morrow. The author cites the case of a town of about 2000 inhabitants which recently came to his attention. The town had no factories of any size, and yet a young man offered to take hold of the plant and have day service on a paying basis in four months. If the company had taken up the proposition the result would have been a failure and another station would report that day service in a small town does not pay. In this same town, however, a profitable day load could be secured in a reasonable time.

The equipment of a station may be such that only comparatively large units are available. In this case it may be necessary to install an additional small unit to take care of the day service. A central station that recently started a day service decided to install an additional boiler before starting this service. It found later that because of the better attention given to cleaning boilers, because there was an extra boiler, the fuel required with the all-day service was actually less than for the night service only. Before starting the day service the company should connect all consumers on meters.

When a day service is once started the company should let everybody know that it is there for them to use and that it is reliable. With day service, reliability is of as much importance as for the lighting service at night. The service should also be advertised. The man or woman who does not read any newspaper is not likely to be a customer of the central station. Advertising matter for various energy-consuming devices can be secured from the manufacturers gratis. In starting the campaign for day service some form of card index should be used to keep a record of prospects and the success had with them. Every residence consumer should be on the card index and a note made whether an electric laundry iron is used.

Mr. Wagner is convinced that a small central station should carry electrical supplies and do wiring, and when wiring a building see that provision is made for laundry iron, coffee-grinder or other apparatus that it expects to sell a consumer later. His company carries a stock of small motors and several sizes of pulleys and belts ready for installation in case a possible consumer's engine breaks down. Immediate service at such times secures a customer. The company should not only keep a stock of energy-consuming devices, but arrange to show its confidence in the quality and reliability of the apparatus by offering to place them on trial. This scheme has been successfully used by both large and small central stations. If a prospective customer can be induced to allow the installation of a motor on 30 or 60 days' trial, free of expense except for the energy used, with the understanding that if not satisfactory the company will remove it, he will usually decide to keep it.

In soliciting business for day service the load factor should not be overlooked and the sale and use of apparatus that consumes a large amount of energy for a short time should be discouraged. Frequently such installations are thrown in circuit at the most inconvenient time.

What can be done in the line of day load is well shown, Mr. Wagner said, in an article in the *Electrical World* of Jan. 21, 1909, which told of a small central station that has its yearly peak load on Tuesday afternoon in midsummer. Motor business is essential to day service, but there are other good and very profitable appliances, such as laundry irons, washing-machine motors, fan motors and devices which bring in small individual revenue, but swell the total and make electric service indispensable. It is advisable in wiring either old or new residences to anticipate the use of electrical cooking devices and run sufficiently heavy wires to proper outlets in the kitchen and dining-room. In most small towns water is pumped at large expense and can be done considerably cheaper by motors.

Inquiry among customers brings out the statement that they have no use for light during the daytime. It is, however, surprising how much light is used during the day when the service is available. Stores having dark corners that were not used before will use the light to make these corners available. Basements will also be more generally used.

Inquiry among Minnesota central stations shows that day service is given in seven towns of 1000 to 2000 inhabitants; eight of 2000 to 3000 inhabitants; seven of 3000 to 5000 inhabitants; 15 of 5000 to 10,000—a total of 37 giving day service out of a possible 112. Three stations have a so-called ironing day; that is, they operate one-half day each week to permit of electric ironing. Of the seven stations in towns between 1000 and 2000 inhabitants giving day service, four use storage batteries for the purpose.

HEATING DEVICES FOR DAY LOAD.

Mr. E. L. Callahan, of the General Electric Company, gave a paper on the building up of a day load with the aid of electric heating appliances. He said that no central-station company now questions the profitableness of a day load obtained from electric heating appliances. While much had been said regarding the use of electric motors for building up day loads, he pointed out that conditions are favorable to creating a day heating appliance load among residences. He took, as an example, a residence consumer having 1 kw maximum demand and yielding a revenue for lighting alone of $24 per year. By the use of the electric flatiron this revenue might be increased $10 per year, and with a toaster $6 per year, making $16 per year added without the increase of a cent in the installation to serve the consumer. He called attention to the practice of the central station at Grand Rapids, Mich., which makes it a point to see that an electric iron is placed in a house wherever a new meter is installed. He read letters from various central stations on the number of irons in use. At Burlington, Wis., with a population of 3000, there are 250. At Huntington, Ind., population 20,000, there are 750.

ELECTRIC MOTORS FOR DEVELOPING DAY LOAD.

Mr. George J. Cadwell, manufacturers' agent, Minneapolis, presented a paper on small electric motors and their possibilities in developing day load. He called attention to the specific applications for electric motors found in small towns. Beginning at the hotel, there are dumb-waiters, potato-peelers, meat-choppers, dish-washers, knife-grinders, silver-buffers, ice-cream freezers and dough-mixers. In the hotel laundry there are washing machines, and every hotel should have a vacuum cleaner. In hotels, restaurants and saloons motor-driven refrigerators reduce the cost of refrigerating considerably. The ventilating of such places cannot be handled better than by motor-driven fans. The restaurants can also use all of the kitchen machinery mentioned in connection with the hotel. The saloon should have a motor-driven beer-pumping and carbonating machine. In the dry-goods business the electric motor can be applied to dumb-waiters, moving window displays, cash-carriers and elevators. The drug store can use motors for ice-cream freezing and carbonating machinery. The grocery has its coffee-grinder and the meat market its meat-grinder and meat-chopper, also refrigerating machinery. Offices use motors for turning adding machines, addressing machines and phonographs, while electric exhaust fans take care of the ventilation and the vacuum apparatus keeps the office clean. At the bakery, dough mixing and the making and pulling of candy can be done by electric motors. In the shoe shop shoes are repaired while you wait, thanks to the small motor. In the barber shop vibrator motors massage the face and polishing motors shine shoes. Newspapers and job printing establishments are equipped with motors. The livery stable uses a motor for clipping and grooming and another for the feed. The blacksmith shop has a motor-driven forge blower, drill press and grindstone. In laundry work there are especial advantages for motors for direct driving, doing away with the dirty belts and saving loss in transmission. The grain elevator has conveyors, cleaners and corn shellers for motor possibilities; the dairy has a motor for churning, cream separators, pumps and refrigerating machines. Doctors use motors for static machines and dentists use them for running drills and lathes. Moving-picture shows use motors for the picture machines, for ventilating fans and for the automatic pianos. Theaters use them for ventilating, for raising and lowering curtains, as well as for vacuum cleaning. Churches need motors for vacuum cleaning, heating and ventilating fans, also for the organ blower. In the residence there is much work that can be done by motors. It is comparatively easy to apply

one motor to a number of different tasks, such as running the washing machine, sewing machine and dish washer. The motor being small can be mounted on a portable stand and connected to a plug in a lamp socket. Another application of general interest is that of the small motor-driven house pump, both for general water supply and for seepage and sewerage. Where there are apartment houses or flats, vacuum cleaning is an attractive field. Where a town consists of small detached residences a profitable business may be worked up by some enterprising man with a portable electric cleaning outfit which could be easily connected up wherever the residences are wired. Mr. Cadwell also called attention to the possibility of extending lines to farms in the surrounding country.

DISCUSSION.

Mr. B. W. Cowperthwait, of Faribault, gave it as his experience that 90 per cent of the irons connected on trial stay in service. The 10 per cent that come back do so, not because they are unsatisfactory, but because there is some special reason why the consumer has no use for the iron. He also called attention to the fact that electric irons have an important influence on the increase of a consumer's bill, whereas small motors do not add greatly to the revenue.

Mr. H. J. Gille, of Minneapolis, commented on the paragraph in Mr. Wagner's paper discouraging the solicitation of business having a poor load factor which yields small revenue and creates high maximum demand. He thought that if such business did not come on during the peak load it might be profitable, and that 33 per cent load factor for a machine shop, which had been spoken of, was remarkably high. In most cities a 20 per cent load factor for a machine shop would be excellent. Although the small motor might not add greatly to the revenue of a central station it was one of the numerous things which make electric service desirable and popularize the use of electricity. He reported 3000 electric irons in use in Minneapolis. In one case he found that there were seven irons in a house: two in the laundry, one in the kitchen, one in the girl's room, etc. He also pointed out that whatever industrial work in the shape of heating or power load is done in the home does not come on during the peak.

Mr. A. C. Westphal, formerly superintendent of the municipal plant at Staples, gave his experience in starting a day service at that place. Before day service was started considerable advertising was done in the papers. At the offices of the plant various devices for using electricity which would be used during the day were displayed and the amount of electricity consumed by each was given. The cost for producing electrical energy in the plant previous to starting the day load was 5 cents per kw-hour. The first month the day service was given this cost was increased to 7.5 cents per kw-hour because of the extra man required to run the plant during the day. By December, however, the cost per kw-hour had been reduced below what it was 12 months previous. The plant had started with 154 customers in the fall of 1907 and had 480 when he left, Feb. 1, 1909. There were 180 electric irons connected and 60 hp in small motors. A number of these operated pumps for consumers beyond the reach of the city waterworks. Another member reported 400 consumers in a town of 2300 population. There were 40 to 50 flatirons and a number of washing-machine motors.

Mr. N. M. Argabrite, of Winona, did not think it necessary to keep motor and lighting service on entirely separate feeders in all cases. His company has some very large motors on feeders used exclusively for that purpose. Some of the smaller factories, using 25 hp and less, were placed on a mixed motor and lighting feeder. The more important lighting of business and residence districts is accomplished on separate lighting feeders.

Mr. F. C. Nelson, of South St. Paul, reported that his company had nearly all motors on lighting circuits. He called attention to the application of an electric motor for portable wood-sawing outfits instead of the gasoline engine formerly used. Such an outfit has a motor running at 1200 r.p.m., direct-connected to a circular saw.

Mr. H. J. Gille, of Minneapolis, said that modern methods of heating and ventilating buildings all required the use of fans. He called attention to the fireless electric cooker as a substitute for the oven, and thought this destined to be one of the most popular electrical devices known and advised members to investigate its merits.

Mr. Alfred Horne, of Fairmount, reported having one complete electric cooking outfit in use, which is placed on a separate meter and billed at a 4-cent rate. The cost to the family is $4.50 to $5 per month. An effort is made to get all residences wired for electric cooking when the house is built. A number of washing machines in the town are motor-driven. A shaft is put up in the laundry, the washing machines, water pumps, mangles, etc., being run from the same motor. The revenue from electric flatirons in Fairmount averages about $1 per month per iron.

Mr. A. H. Lane, of Glencoe, pointed out that it takes several motors to yield as much revenue as one good cooking utensil.

Mr. N. M. Argabrite, of Winona, by way of illustration of the fireless-cooking principle, cited the example of one of the employees of his company who had done a remarkable amount of electric cooking simply by placing a 2-cp incandescent lamp inside of a hay stove. In speaking of the relative desirability of a load which consists of a number of small motors as compared with one large motor, Mr. Argabrite was impressed favorably by the small motor load because these small motors usually yield a better rate per kw-hour and there is usually a sufficient diversity in their hours of use so that the load does not all come on at once as in the case of a large motor.

INTERIOR WIRING AND ILLUMINATION

Fixtures for Artistic Interiors.

At the meeting of the Chicago section of the Illuminating Engineers' Society, June 17, Mr. Albert Frank Horton, of the "Electric Shop" of the Commonwealth Edison Company, gave a lecture illustrated with stereopticon on fixtures for artistic interiors. He first called attention to the fact that the architect is the storm center of the various constructing and decorative interests. The decorator has a contempt for any piece of work which does not show a liberal expenditure for his branch of the work. The woodworker looks only at the wood finish. The speaker, as a lighting-fixture man, thought that the lighting fixtures should receive first consideration. The general effect of the work of the interior decorations will depend very much on the lighting fixtures and their arrangements. Fixtures are also decorative features in themselves. The illuminating engineer and architect should co-operate and work in harmony. He thought that 5 per cent. of the cost of the building should be the minimum amount appropriated for lighting fixtures. These fixtures are the most permanent feature in the room. Walls and woodwork require re-finishing, but good fixtures will be lasting. He brought out the effect of illumination on the dimensions of a room. By highly illuminating, the ceiling walls or floor, they are made to recede. Light ceilings seem to make high ceilings; with light walls the room will seem larger than with dark. He thought that the floor should be comparatively dark to make it seem solid, as a light floor gives a sense of uncertainty.

Local lighting for special purposes, such as reading or sewing, should be considered separately from general lighting. The danger to avoid with general lighting is that of making it too local or uneven. With local lighting the danger is that the lighting may be too concentrated without sufficient general lighting.

He condemns the use of opaque or concentrated reflectors with no light in the room except that thrown by the reflector. He then showed a large number of lantern slides

giving photographs and drawings of very artistic interiors, and called attention to the good and bad points of each. These slides and his remarks related almost entirely to the most expensive class of work.

Street Lighting at Shawnee, Okla.

Mr. F. W. Caldwell, manager of the Shawnee Gas & Electric Company, of Shawnee, Okla., gave some interesting statistics relative to street lighting in his city at a recent meeting of the Oklahoma Electric Light, Railway and Gas Association. During the latter part of June 1908, his company installed a block-lighting system on Main Street, and during the following month four additional blocks were lighted. Extending 5 ft. over the sidewalk from the front of the building, and fastened to a Cutler elite street hood bracket, 60-watt tungsten lamps were installed every 25 ft. Each lamp was enclosed in a 10-in. diameter, 4-in. top, opal globe, and the company received $5 per installation and $1.50 per month for each fixture, the lamps burning from dusk until 10 o'clock every night excepting Saturday, when they burn until midnight. The cost of each fixture is given as follows:

Bracket and socket	$1.25
Opal ball	.60
Weatherproof holder	.40
60-watt tungsten lamp	1.30
Freight on above	.30
Wiring bracket	.15
Total	$4.00

The service leads are run along the front of the buildings at a cost not exceeding $1 for each installation, and the company furnishes lamp renewals. During the summer the watt-hour consumption per fixture is as follows:

One 60-watt lamp, two hours	120 watt-hours per night
One 60-watt lamp, two hours for 26 nights	3,120 watt-hours
One 60-watt lamp, four hours for 4 nights	960 watt hours
Total for month	4,080 watt-hours

During the winter this consumption is more than doubled.

The lamps are installed sufficiently high so as not to interfere with window lighting, and opal globes giving a mellow carnival light are selected, so as not to detract from the sign lighting. The lamps in each block are controlled by one switch, and the flat-rate window lamps and signs are cut in on the same circuit. While the company appreciates that a fair income can be secured by this class of business, the main consideration is that it is one of the best possible advertisements for the city. The night retail trade is also thereby stimulated, since the people remain on the streets longer at night, and the gross income from lighting is materially increased. Mr. Caldwell stated that the block-lighting system has pleased the people of his city more than all the other schemes his company has tried combined.

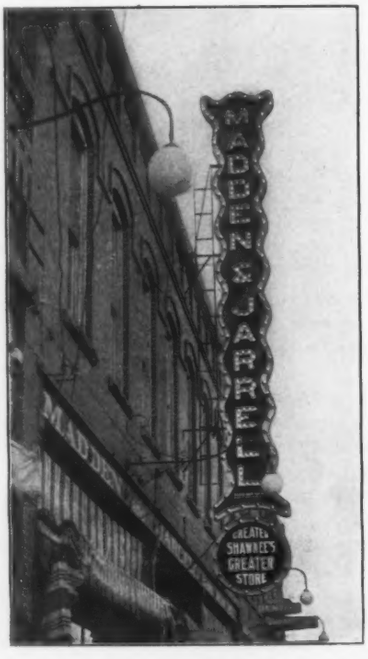


FIG. 1.—DETAILS OF LAMP BRACKETS.

In soliciting for this business the company determined, as nearly as possible, what each merchant could afford for this service. The service was designed so as not to interfere with the window or sign lighting, and the cost was based on an installation that would look attractive by day as well as by night. The merchants on one block were then approached and a solicitor stated that the company proposed to experiment with a block-lighting system and that the cost would be 5 cents per night and $5 for the installation, provided everyone on both sides of the street agreed to maintain the service. The store merchants were also informed that if after the system had been perfected and all did not feel that it was worth the cost, that the company would remove the fixtures, etc. After securing one block it was found that committees on other blocks immediately took up the work in self-defense. The Shawnee Gas & Electric Company feels that a flat rate is best for this service for many reasons. In the collection of accounts it is the policy of the company not to cut off a customer for non-payment. If there are many delinquents the matter is taken up with the commercial club, board of trade or town boosters, who thoroughly appreciate that the town cannot afford to lose the block-lighting system when once installed, and who either maintain the system or assist the company in collecting the bill. The accompanying illustrations show the details of this lighting system.

FIG. 2.—BLOCK LIGHTING AT SHAWNEE, OKLA.

Scheme for Pulling Conductors in Conduit.

By Arthur Gillman.

Various methods have been described from time to time for fishing conduit and for fastening the fish wire to conductors or to pulling-in lines. In drawing the wire into the conduit, many methods prevail and it is the intention of the writer to discuss in the present article methods of drawing the pulling-in line into the conduit with the fish wire and also to describe some schemes employed in drawing in the conductors, especially in heavy work.

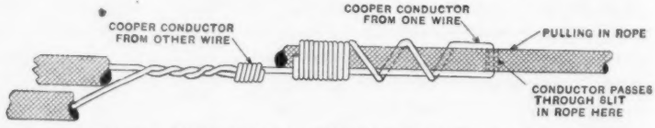

COOPER CONDUCTOR FROM OTHER WIRE
COOPER CONDUCTOR FROM ONE WIRE
PULLING IN ROPE
CONDUCTOR PASSES THROUGH SLIT IN ROPE HERE

FIG. 1.—CONNECTION OF CONDUCTORS TO DRAWING-IN ROPE.

ADJUSTING THE PULLING-IN LINE.

Assuming that a fishing wire has been pushed through a conduit and attached to the drawing-in line by one of the methods in use, the drawing-in line is pulled into the conduit. Usually no great tension is necessary to accomplish this.

The wiremen merely take hold of the end of the fishing wire extending from one conduit outlet, pull on it and the drawing-in line is drawn in at the other outlet. If the drawing-in line is one strand of galvanized steel the conductors to be pulled in are made fast to it and served with tape so as to form a conical

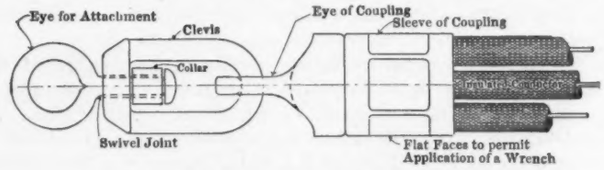


FIG. 2.—CONDUCTORS WEDGED IN COUPLING.

wedge. If two strands are used for drawing in, the conductors may be passed through the loop and bound with copper wire serving after being bent back on themselves.

Conductors are attached to a drawing-in rope in the manner delineated in Fig. 1, wherein one conductor is passed through a slit cut in the rope and then "made up" around it and the second conductor is "made up" around the first one. The connection is, of course, afterward thoroughly taped. Where a severe tension is to be expected it is a good precaution against untwisting to solder the conductors where one is served around another and at any other points where soldering is feasible and would retard any tendency to untwist. Appliances have been developed by means of which conductors can be quickly fastened to pulling-in lines without its being necessary to make time-consuming servings and splices. These convenient devices have not been used much in interior conduit

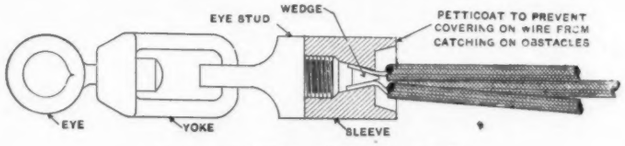


FIG. 3.—SECTION SHOWING WEDGE.

work. It appears that all types were designed for drawing cables into underground conduit where no sharp turns occur and most of them would not draw around the elbows that are standard in wrought-iron conduit construction. Unquestionably it would pay to use such devices, or modifications thereof, on wrought-iron conduit jobs involving large conductors where the value of the time taken in making connection between pulling-in lines and conductors runs into astonishing figures. Fig. 2 illustrates one type of coupling, designed for attaching three-phase underground cables to a steel cable pulling-in line and it could be used successfully for pulling conductors into straight runs of wrought-iron conduit. Fig. 2, an assembled view, shows the conductors held in position ready to be drawn in. Because of the tendency of steel cable to twist when put under tension, the swivel joint shown is necessary. If it were omitted probably a cable being drawn in would be twisted. Fig. 3 indicates at the sectional portion the manner in which a conical wedge clamps the three conductors to the coupling. Dimensional details of the device are given in Fig. 4. The eye, yoke, conical wedge and key are of wrought iron and the sleeve is of bronze. Figs. 2, 3 and 4

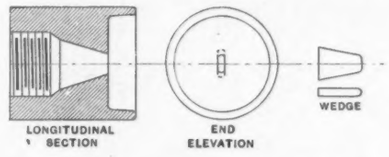


FIG. 5.—SLEEVE FOR TWO-WIRE COUPLING.

show a coupling designed to accommodate three wires. To adapt one for two wires a different sleeve and wedge (shown in Fig. 5) would be required. In using the device the conductors are bared, placed in position in the hole in the sleeve and the conical wedge inserted and given a smart blow with a hammer. This sets the wedge and tension on the conductors intensifies the clamping action.

Inasmuch as the complication of the yoke and eye (see Fig.

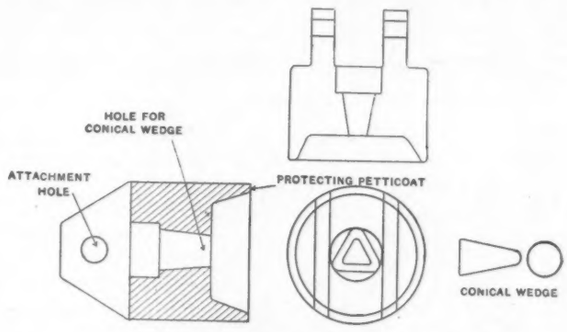


FIG. 6.—MODIFIED COUPLING.

4) is only necessary where a twisted steel cable or a twisted rope is used for pulling, for interior conduit work (where braided ropes or galvanized-steel wires are the rule), the involved construction shown in Fig. 4 can be changed to that indicated in Fig. 6. This illustration shows a coupling for three-wire work. For two-wire work such an appliance should follow the design detailed in Fig. 5. The pulling-in line is attached directly to the coupling shown in Fig. 6 by making it up through the attachment hole indicated. The protecting petticoat extends out far enough to prevent the insulating covering on the conductors from catching in a conduit. The coupling should be made of bronze and the conical wedge of steel.

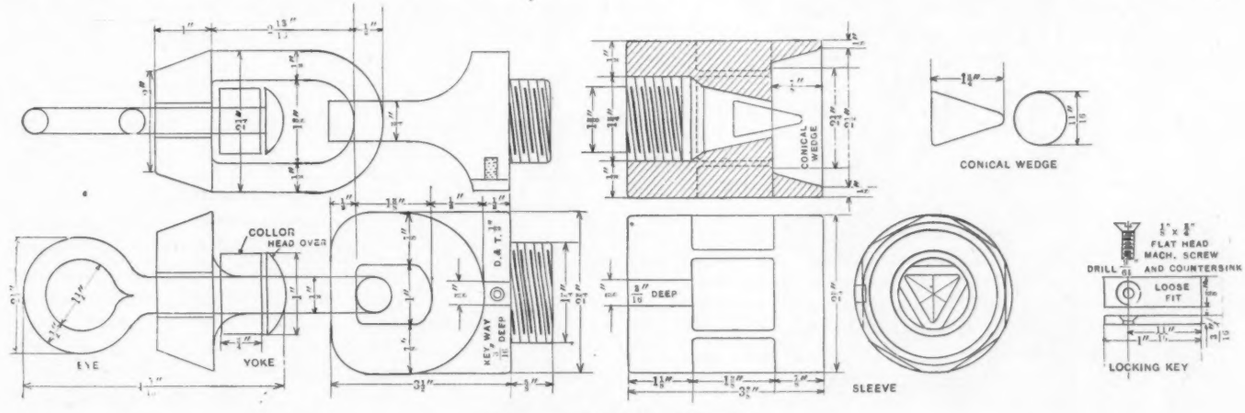


FIG. 4.—DETAILS OF COUPLING.

DRAWING THE CONDUCTOR INTO THE CONDUIT.

The fishing wire having been fastened to the conductors as described, the latter may be drawn into the conduit. If a ribbon fishing wire is to be used for pulling-in it follows that the

conductors are small and the pull light. A heavy pull should not be attempted with a ribbon wire, as it will doubtless be rendered unfit for future service. If more force is required for the pulling than can be exerted by two men, each having a hold on the wire and walking along the floor, either galvanized steel wire or braided rope should be used for a pulling-in line. As outlined above, for very heavy pulls it is advisable

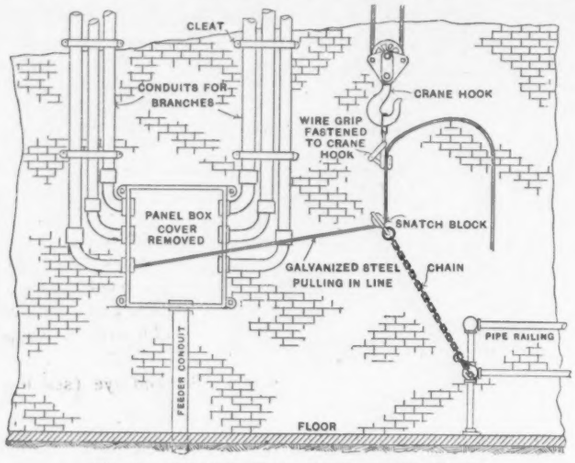


FIG. 7.—PULLING WIRE WITH CRANE HOOK.

to use several strands of steel wire and the copper conductor servings at the point of connection between the conductors and the pulling-in line should be soldered. It is very diffucult to get a secure grasp on a ribbon fishing wire with the hands when it is being used for pulling in, and it is almost impossible to pull against any considerable strain by this method. Wiremen sometimes bend the bight of the wire around a stick or otherwise distort it in order to gain a hold, but this is bad practice as the kinks so formed can never be entirely removed, though they may appear to be so. A wire so punished will always give trouble when used for fishing.

An excellent method of securing a hold is through the means of a parallel jaw-grip, used extensively in line work. The surfaces of the two parallel plates between which the wire is clamped are smooth and will not mar the fishing wire. The fact that this type of grip is successfully used for pulling up hard-drawn copper wire is sufficient recommendation. A spring, with which the clamps are equipped, tends to clamp the grip lightly on its wire, preventing it from falling off. When a

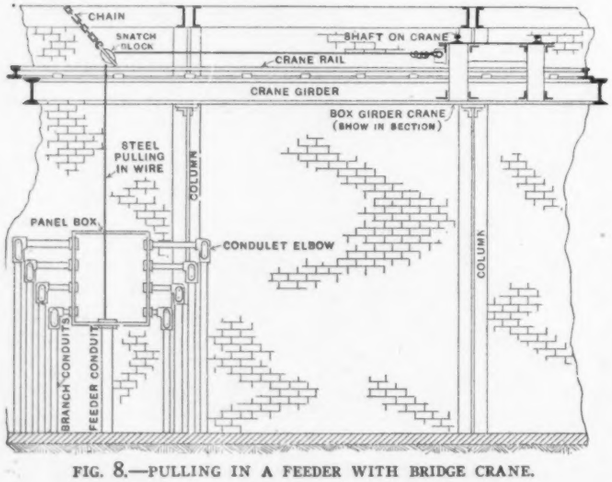


FIG. 8.—PULLING IN A FEEDER WITH BRIDGE CRANE.

pulling strain is applied at the loop, the clamping effect is intensified. Three sizes of this clamp are manufactured, each respectively capable of accommodating from an infinitely thin wire to No. 6, No. 0 and No. 0000. In using the grip it is placed on the wire to be pulled and a rope is tied into the loop. The rope provides a good hold for the wireman's hands.

Heavy conductors can be drawn in with the fishing wire if it be of galvanized steel, therefore all of the methods to be described in what follows are applicable in such a case.

The necessity of a pulling-in line implies a heavy pull. The usual method of getting the desired force is through the means of a set of tackle blocks. One block of the set is provided with a loop and the other with a hook. The block with the loop is made fast to some substantial object and the hook of the other block is engaged with the pulling-in line, either by a knot if the line is of rope or by a clamp of the parallel-jaw grip type if the line is of wire. Able-bodied wiremen and helpers at the free end of the rope from the tackle blocks supply the power. Obviously it is but a matter of enough men and sufficiently heavy tackle to pull in the most difficult run. But it is slow work, as the ordinary run of tackle blocks will have three or four pulleys each, which means that the men must carry the free end of the rope from the blocks six or eight times as far as the conductors are drawn into the conduit. Each time the blocks are pulled to their limit, the pulling-in line must be disengaged from the block hook, the blocks pulled as far apart as the line will permit and the pulling-in line from the vertical to one parallel to the crane girder. Where

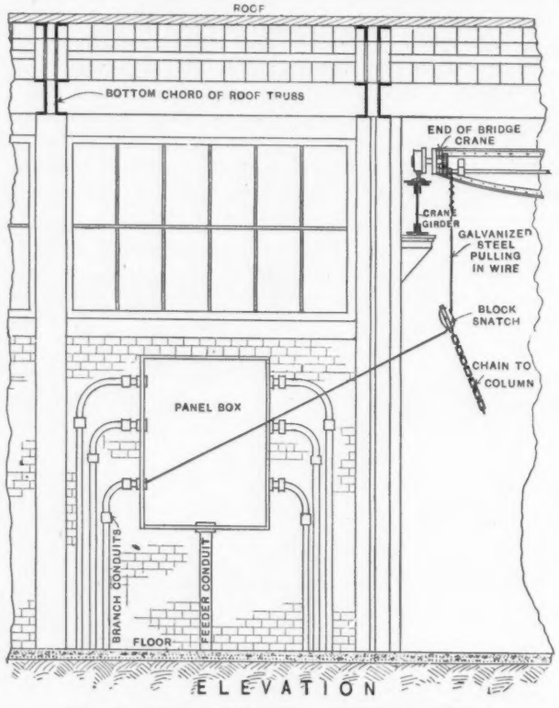


FIG. 9.—PULLING IN FEEDER AROUND A CORNER.

cranes are available the method described below is a time-saver.

Cranes are used freely in industrial plants. They are frequently installed in buildings under construction as soon as there is enough steel erected to carry them, inasmuch as they are availed of in handling construction materials and equipment for the new building. The electrical construction man can use them for pulling in wire economically and quickly.

Fig. 7 illustrates how conductors can be pulled into a branch conduit with the hoisting hooks of a crane. The pulling-in line is shown as of galvanized steel and attachment is effected between it and the crane hook through the means of a parallel-jaw wire grip. In order to insure that the pulling-in line shall pass out directly from the branch conduit without excessive binding the snatch block is restrained with a chain, as shown. A crane capable of hoisting, say, three to five tons 75 ft. or 100 ft. a minute, makes short work of a condition such as that shown. In Fig. 8 are shown the arrangements necessary to pull in a vertical feeder with a bridge crane. Steel wire is used for a pulling-in line and is attached to the crane. A snatch block alters the direction of the pulling-in line from the vertical to one parallel to crane girder. Where

feasible it is better to attach to the crane bridge rather than to the hook, as the bridge speed is usually faster than the hook speed and it is usually possible to pull in a much greater length at one setting by the bridge method.

In a building where there are cranes it is seldom that a conduit outlet will be so situated that it cannot be pulled from, in some way, by one of them. Several snatch blocks may be required in difficult cases, but unless too many changes in direction are necessary it will probably pay to utilize the cranes. Fig. 9 illustrates an instance where a pull is being made around a corner. The method of connection between fishing wire and crane is the same as described in connection with Fig. 8. Monorail cranes can be pressed into service in the manner indicated by Fig. 11, which requires no description. This type of crane is much lighter than the bridge type and sometimes on heavy pulls the wheels slip and spin around on the I-beam rail. If this occurs two or three of them may be coupled together in tandem, or if this fails the pulling-in line should be rerun so that the pulling can be done by the crane hook. The hook may be capable of raising three to five tons. Occasionally conditions are such that yard locomotives in industrial plants can be used for pulling-in wire and in certain installations many hundred feet have been drawn in by this method. It is a very satisfying spectacle to observe the ease with which a yard locomotive will haul in conductors which have responded but feebly to block-and-tackle and man method.

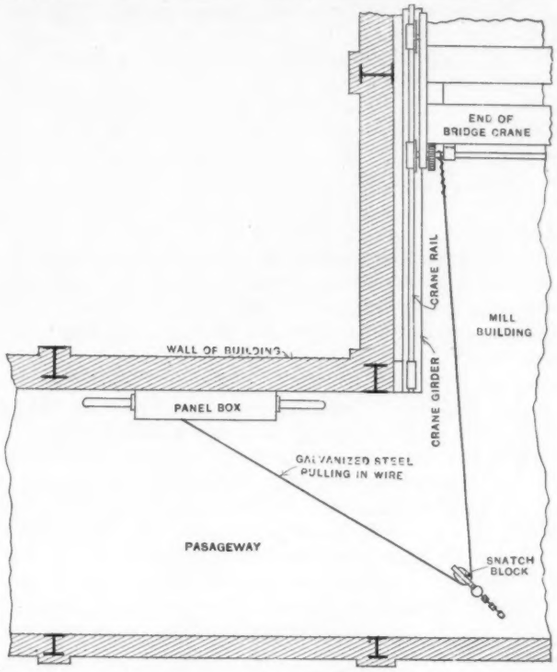


FIG. 10.—PLAN VIEW OF PULLING ARRANGEMENT SHOWN IN FIG. 9.

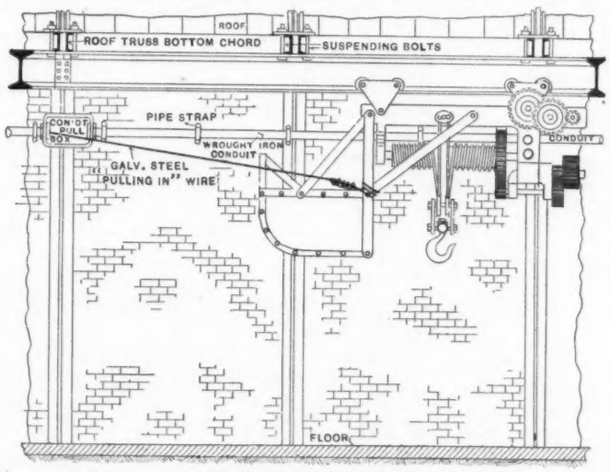


FIG. 11.—PULLING-IN FEEDER WITH MONORAIL CRANE.

LETTER TO THE EDITORS.

Electric Heating Devices.

To the Editors of Electrical World:

SIRS:—It is strangely singular, though by no means inexplicable, how central-station managers, and solicitors in particular, will induce a consumer to load up his circuits with almost every conceivable form of electric-heating device without any thought as to the ability of the consumer to keep such apparatus in operation. Seldom—and this point has been emphasized often—does the manager or solicitor stop to ask himself whether the consumer's income is such as to warrant the installation of certain heating devices, especially if the energy is not sold at very low rates. It is generally admitted that unless low rates for heating circuits prevail, it is out of the question for an average clerk to roast meats in an electric oven in competition with other fuel, unless, of course, there are very urgent reasons for using electricity.

The average solicitor, if he felt that a consumer would take his advice, would suggest that the entire house be electrically equipped, and could frame up enough arguments to convince an easily-led individual that that would be the proper thing to do. This is not only detrimental to the central station and to the manufacturer of heating devices, but to the whole art as well. Even customers who can afford to pay high rates in return for the cleanliness and convenience of electricity, have installed cooking and heating apparatus often at great expense, and discarded it again after a short period of use. Granting that the apparatus itself is thoroughly reliable, it is but right that a consumer be apprised of all the facts in connection with it. The luminous radiator, for instance, is a very pretty piece of apparatus; but as an economical heat producer it is an admitted failure, and for a manager to push apparatus of this kind without stating that it is especially serviceable for bathrooms, sitting-rooms, etc., where heat is required for short periods of time only or to take the chill off the room, only tends to bring discredit and to hinder the legitimate development of the business in other directions. Unless a man has a fairly large income, can he afford to place electric cooking utensils in the hand of the average cook in a family of more than five, for instance? In the first place, the cost of some kettles is such that it would be possible for the same sum to buy a whole outfit of ordinary cooking utensils. Renewals are also costly, and if the manufacturers of heating apparatus would make heating elements in sections and make them as readily replaceable as fuses in a circuit, for example, progress will be made.

There are numerous devices on the market which are very serviceable and which come within the means of even the poorest, or at least anyone having electricity in his dwelling. The first cost is usually the only hindrance to their introduction, and if central stations would rent these as they do flatirons, etc., on a basis commensurable with their convenience, the general public will be likely to entertain the suggestion of the most persuasive and eloquent canvassers employed. There is no doubt a field for extensive operations in this direction if approached in the proper manner. That manner is certainly not to try to bankrupt a consumer by installing apparatus consuming more energy than he is able to buy.

A manager may as well be frank with a patron of his company, and if in his estimation it would be detrimental to the interests of a customer to install certain apparatus, although seemingly advantageous to the electric-light company at first, it would be wise for him so to advise the customer. Such frankness and solicitude always bring their reward.

NEW YORK. JOHN F. ROBERTSON.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Dynamos, Motors and Transformers.

Single-Phase Commutator Motors.—J. Fischer-Hinnen.—The conclusion of his long article giving the principal rules for the predetermination of single-phase commutator motors, both series motors and repulsion motors being discussed. The article is concluded by a comparison of series and repulsion motors.—*Elek. Zeit.*, June 10.

Stray Field of Induction Motors.—Two communications, one by K. Simons and W. Rogowski, the other by R. E. Hillmund, on some discrepancies in the theories developed by these two parties in recent papers on the stray field of induction motors, with special reference to the zigzag stray field.—*Elek. Zeit.*, June 10.

Lamps and Lighting.

Tungsten Lamp.—A note on a recent British patent of the Siemens & Halske Company (19,311, 1908; June 3, 1909). In spite of opposition a patent has been granted on this application. The process described consists in first reducing a mixture of nickel tungstate and tungstic acid, so that an intimate and ductile mixture of nickel and tungsten is obtained. This is rolled and drawn into filaments, the nickel being afterward removed by heating in a vacuum.—Lond. *Elec. Eng'ing*, June 10.

Metallic Vapor Lamp.—O. Vogel.—A continuation of his long illustrated serial on the history and the evolution of the metallic vapor lamp and the present status of its development.—*Zeit. f. Beleucht.*, May 30 and June 10.

Power.

Steam Generating Stations.—G. Rizzo.—An abstract of an illustrated report made to the International Association of Tramways and Light Railways and based on the replies received in response to the questionnaire sent out to members. The author first discusses the various aspects of the boiler-house problem, and shows how, by the use of superheated steam and proper attention to good stoking, much greater efficiency could be obtained than is at present. He then passes on to consider the heat cycles produced by both reciprocating engines and turbines when working under various conditions and shows how a vacuum which is most efficient to use depends on a number of conflicting factors. A summary of the costs for erecting a station containing all the most modern improvements is given in conclusion. The example here given is that of a station supplying a tramway load and containing three horizontal tandem engines, the expansion of which can be varied by a regulator, and which work condensing and on superheated steam at 300 deg. C. Each machine is capable of developing 1450 effective hp continuously when working at a pressure of 12 atmospheres and a condenser pressure of 7 cm of mercury. This power corresponds to an admission of a volume of steam equal to 28 per cent of that of the high-pressure cylinder. The diameter of the high-pressure cylinder is 2 ft. 4 in. and that of the low-pressure cylinder 4 ft. The stroke of the pistons is 4 ft. and the speed is 94 r.p.m. Each machine is directly coupled to a 1000-kw, three-phase alternator, the power factor being 0.9. The rotor of this alternator is of the flywheel type, its moment of inertia being 1100 tons-m². The exciter sets, which work at 110 volts, are fixed on the end of the shaft of each machine. The switchboard contains all the measuring instruments and usual switchgear, together with the feeder panels and the switches for operating auxiliary machinery. The boiler house contains four boilers of the Babcock & Wilcox type, having a heating surface of 3700 sq. ft. An interior superheater delivers steam at 325 deg., while the boilers are fitted with automatic stokers. The installation also has four groups of Green economizers of 90 tubes each, steam-feed pump and another electrically driven. The chimney is 180 ft. high and has a diameter of 8.6 ft. at the top. It is capable of exerting a draft of 13 mm at the furnace registers, and allows the operation of all the six boilers at full load at the same time. The capital outlay for this installation is given in the following table:

Engines, including pipe work	$72,000
Generators, including exciters, etc	36,000
Switchboard and cables	9,000
Boilers	33,000
Economizers	12,000
Pumps and pipe work	14,000
Coal conveyor	5,000
Coal stores	10,000
Land and buildings	50,000
Chimney, cranes and erection	20,000
Miscellaneous	10,000
Total	$271,000

As regards the consumption of coal per kw-hour, it may be noted that with the alternator at one-third load the machine consumes 5200 calories per kw-hour, at half load 5130, at three-quarter load 5530, and at full load 4850. By applying the correction due to the efficiency of the pipe work and that of the boiler, the generating set when running at one-third load develops 1 kw-hour per 6800 calories, at half load 1 kw-hour per 6700 calories, at three-quarter load 1 kw-hour per 5960, and at full load 1 kw-hour per 6400 calories. One kw-hour can therefore be produced per 1.8 lb. of coal, if the load on the network varies between 666 kw and 2000 kw. This consumption of 1.8 lb. of coal takes into account all the losses, including that of lighting the boilers in the morning. Taking the total output of the station as 8,500,000 kw-hours, that is 2850 kw-hours per kilowatt installed, and taking 5 per cent interest on capital, together with a depreciation of 4.6 per cent for the machinery and 3 per cent for the buildings, an expenditure of 0.28 cent per kw-hour is obtained. The other expenses of the station, including wages, lubrication and maintenance charges, may be estimated at 0.14 cent per kw-hour, while coal may be taken as costing 0.45 cent per kw-hour. The total cost per kw-hour, therefore, works out at 0.87 cent.—Lond. *Electrician*, June 11.

Electric Brakes.—M. Müller.—It is a well known fact that the self-excitation of series dynamos does not succeed if the external resistance is beyond a certain value. This is of importance for electric braking on tramways, cranes, rolling mills, etc., where series motors are used, and the braking effect is obtained by running the motors as generators. This is to be taken into consideration in dimensioning the braking resistances in order to get a sure brake effect. The author discusses the excitation of series motors operating as generators, as a function of the resistance of the breaking circuit and the speed of the motor. For special cases, he defines a "critical resistance." He finally shows how to predetermine the instantaneous variation of the exciting current from the technical data of the motor. The author finds that for the proper production of the braking effect the following points are of chief importance: First, the magnetizing curve at low current, and the remanent magnetism of the motor. The excitation will be the quicker the smaller the ratio of the total ohmic resistance of the braking circuit to the speed of the motor. The braking effect is not obtained if this ratio is above a certain value. Other things being equal, the time required to obtain complete excitation is directly proportional to the number of the field windings and inversely proportional to the number of armature conductors connected in series.—*Elek. Zeit.*, June 10.

Magnetic Cranes.—C. Michenfelder.—The conclusion of his illustrated article on electromagnetic cranes for loading and unloading. Besides a review of recent progress made in the design of such cranes, the author gives an account of the favorable results obtained in a large German rail plant with magnetic cranes for loading rails.—*Elek. Zeit.*, June 10.

Petrol Motors.—Watson.—An illustrated paper on the thermal and combustion efficiency of a four-cylinder petrol motor, which contains what is probably by far the most complete

record of a series of trials with a motor under varying conditions which has yet been published.—Lond. *Engineering*, June 11.

Traction.

Overhead Construction for Railways.—An illustrated article on the electrification of the L. B. & S. C. Railway's South London line. The article gives considerable details of the overhead construction. Each catenary is separately erected and separately adjustable by means of two turnbuckles placed in each catenary span. Only three types of insulators are used and the insulators of each type are interchangeable. All three types of insulators are of the spool pattern, and they are all used in such a way that the axis of the insulator is in the horizontal plane, so as to provide for the surfaces of the corrugations being kept fairly clean by natural means. Double insulation is used throughout the whole construction, and only porcelain is used as an insulator. The double insulation is supplied by what is called the main insulator and a smaller one known as the auxiliary one. All the main insulators have been tested to 65,000 volts for 30 minutes, and the auxiliary ones to 25,000 volts for the same period. The third type is used in connection with the section insulators and for supporting the trolley or collector bow fixed to the top of the motor-car roof. The trolley wire is circular in section and 1 in. in diameter, having a groove on either side into which the mechanical clips fit by means of which the conductor is supported from the catenaries. The droppers supporting the trolley wire are solid rods, having loops at one end hung in corresponding loops, fixed by means of special clips to the trolley wire. When the length of a dropper exceeds 3 ft. 6 in., droppers composed of two sections, one hung from the other by means of a loop, are used, so as to give the greatest flexibility in the vertical plane while assuring the greatest rigidity in the horizontal one. The relative weight of the clips to that of the trolley wire was so small that, with the arrangement of supports adopted, there is no knock of any kind when the collector bow passes under a trolley-wire clip.—Lond. *Electrician*, June 11.

Steam and Electric Traction.—W. E. DALBY.—A Royal Institution lecture on the relative merits of steam and electric traction. There was, he said, little difference between actual efficiency of the two methods, as in each case about 4 per cent of the energy of combustion of the coal was utilized for traction. For long, non-stop runs steam was most satisfactory. The traveling public would not pay for high speeds, but, if they wanted them, electric traction would have to be employed. For frequently stopping trains with high schedule speeds, electric traction was inevitable.—Lond. *Elec. Eng'ing*, June 10.

Speed Curves.—T. FARMER.—An article in which the author sets forth a simple method of utilizing the distance-time curve for obtaining velocity and acceleration readings direct.—*Elec. Rail'y Jour.*, June 19.

Installations, Systems and Appliances.

Melbourne.—J. H. DAVIES.—An illustrated description of the municipal electric central station of Melbourne. There are two distinct systems of generation: direct current at 460 volts between outers and single-phase alternating current at 4000 volts. In the engine house these systems are kept entirely separate—being installed at opposite ends of the room. The direct-current generating plant is rated at 3850 kw. The single-phase plant contains two generating units, each being a 750-kw turbo-alternator. The direct-current arc lighting of the streets is done by 135 Excello converging-carbon flame lamps, burning nine in series across the 460-volt outers of the direct-current system. In the center of the city the lamps are 25 ft. above the ground, and are spaced about 80 yd. apart. The lighting of the by-streets and rights-of-way is now done by 32-cp, 230-volt carbon-filament lamps. The single-phase current is transmitted to 18 transformer substations. There are two sets of transformers in a substation, one stepping down to 400 volts for supply to private customers and for incandescent street lighting, and the other transforming to 1200 volts for public arc lighting. The middle point of the secondary side of the 400-volt transformers is earthed at the substations, and supply is given on the three-wire system, incandescent lighting and small motor supplies being at 220 volts, while motors of 2 hp are connected to the outers. The transformers for public arc lighting have a number of taps brought out from the unearthed end of the secondary winding, so that various pressures from 800 volts to 1200 volts may be used according to the number of lamps in the circuit. These arc lamps are of the A. E. G.'s converging-carbon flame type, some 550 in all. The lighting of the lanes is done by 200-volt, 32-cp incandescent lamps. The Council does considerable business in hiring out arc lamps. Contracts are made including the hire, supply of energy, carbons, and all switch and attendance. This arrangement is very popular, and some 1100 lamps are let on hire on this plan, and mostly for illumination outside shop windows. Contracts are also made for attendance and recarboning of consumers' own lamps; or lamps may be hired and cared for by the user, who only pays in addition for energy.—Lond. *Elec. Review*, June 4.

Extensions of Sydney Station; Protection of Condenser Tubes.—Considerable extensions are to be made to the power house at Sydney, which now has an annual output of 9,000,000 kw-hours. Major Cardew, who has just reported on the undertaking, recommends the installation of 4000-kw turbo-alternators and the erection of a coal-conveying plant. Troubles have been experienced with the condenser tubes, and different methods of preventing corrosion due to electrolytic action are being tried. W. H. Allen, Son & Company use plain brass tubes in conjunction with cast-iron water boxes and end covers, the tube plate being of the same composition as the tube. Zinc plates are placed in the water boxes and in the suction culvert for circulating water. The method adopted in the Harris-Anderson system consists in using aluminum plates supported from the tube plate in the water spaces at either end of the condenser. Aluminum, continues Cardew, is more strongly electropositive than zinc or brass, and he suggests that aluminum plates should be tried instead of the zinc plates now being tried at Sydney, although it would be more difficult to ensure a thorough metallic connection between the tubes and the plates. Experiments are also being made with tinned and untinned tubes. Cardew favors the use of the latter, and suggests that they should be made of an alloy of 71.4 per cent copper to 28.6 per cent zinc. They should be connected to the tube plates by lead grommets.—Lond. *Elec. Eng'ing*, June 10.

Distribution Department.—H. F. J. THOMPSON.—An article on the proper organization of the distribution department of an electric central station. The author discusses the composition of the staff, and the organization of the meter department, the clerical department, the publicity and installation department, the handling of applications for the supply, the handling of complaints, the making of repairs, etc., in emergency cases.—Lond. *Elec. Review*, June 11.

High-Tension Circuit-Breakers.—HENRY.—The first part of a serial on modern high-tension circuit-breakers, principles of their construction, methods of automatic operation, etc.—*L'Industrie Elec.*, June 10.

Fuel Economy.—J. IZART.—The conclusion of his illustrated serial on methods of improving the fuel economy in central stations, emphasizing especially the advantages of recording instruments.—*L'Industrie Elec.*, June 10.

Wires, Wiring and Conduits.

Transmission Poles.—A note on a recent investigation by Gaisset on the calculation of the transmission poles and conductors. The maximum stress must never exceed about one-quarter to one-third of the breaking stress. The wires should, of course, be so arranged that they can never touch each other, and the installation costs per kilometer of the conductors should never exceed with the greatest possible span a certain fixed limit. Calculations made by the author show that the costs per kilometer on a straight run are a function of the height of the poles. The results are given in Fig. 1, where

curve 1 is for wooden poles, curve 2 for U-iron poles, curve 3 for armored concrete poles, and curve 4 for lattice-work poles It will be seen from these that for each type of mast there is a certain height for which the installation costs of the line are a minimum. It is only possible to compare together seriously curves 3 and 4, as with these a mean life of 30 years can be obtained, while the average life of the wooden poles is only

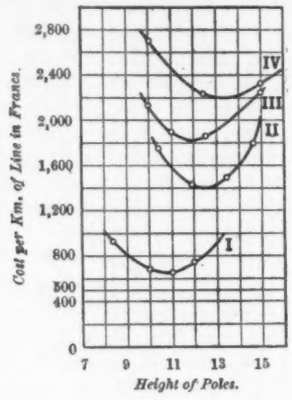


FIG. 1.—TRANSMISSION POLES.

about 15 years. The values given for curve 1 should, therefore, really be doubled. For transmission lines with many curves the values for wooden and concrete poles have to be taken considerably higher, owing to the necessary stiffening required.—Lond. *Electrician*, June 11.

Fittings.—W. A. Toppin.—The author emphasises the importance of proper provision for attaching electric fittings to the wiring of the building. Seven different methods of attachment are illustrated by diagrams and their merits are critically compared.—Lond. *Elec. Review*, June 11.

Electrophysics and Magnetism.

Inertia and Mass.—V. Dwelshauvers-Dery.—A paper discussing the question whether modern physics has demonstrated that what rational mechanics calls "mass" varies with the speed, the latter science having thus been upset down to its very foundations. The author strongly denies that the work of Abraham and Kaufmann has in any way demonstrated that the material mass of bodies is variable, as they use the terms inertia and mass wrongly. "On supposing it to be finally demonstrated by experience that this resistance of electromagnetic origin, wrongly styled 'inertia or mass,' follows in the case of cathodic corpuscles the laws indicated by the new theory it would not signify that these laws could be extended to free material, non-charged, points. The supposition that the real inertia of matter has an origin, even an electromagnetic origin, is only an evasion without scientific value, which conceals the simple change of signification given to the word mass."—Lond. *Engineering*, June 11.

Electrochemistry and Batteries.

Fixation of Atmospheric Nitrogen.—A. Bernthsen.—A paper read before the International Congress of Applied Chemistry in London. The author deals especially with the new Schoenherr process of the Badische Company, recently described in the Digest. Concerning the efficiency of this process it is stated that the gases leaving the tube contain about 2 per cent of nitric oxide, that is, they are from one and a half times to nearly twice as concentrated as the gases which Birkeland and Eyde produce. It is interesting to note that the arcs produced in Schoenherr's process send out electrical waves, and as a result of this a method has been worked out by the Badische Anilin & Soda Fabrik for producing electrical oscillations of great frequency suitable for use in wireless telegraphy.—Lond. *Electrician*, June 11.

Fixation of Atmospheric Nitrogen.—S. Eyde.—A paper read before the Royal Society of Arts in London on the Birkeland-Eyde process. The author describes the chemical methods of working up the dilute gas mixture containing nitrogen oxides in the marketable products.—Lond. *Electrician*, June 11.

Calcium Carbide and Cyanamide.—The conclusion of the very long and fully illustrated serial on a large new Norwegian electric furnace plant for making calcium carbide and cyanamide.—Lond. *Engineering*, June 11.

Cyanamide.—J. Escard.—An illustrated article on the electrochemical method of making calcium cyanamide and its properties and industrial applications.—*L'Industrie Elec.*, June 10.

International Congress.—An account of the papers of electrochemical interest presented before the International Congress of Applied Chemistry in London. They deal with the use of the electric furnace in the iron and steel industry, the fixation of atmospheric nitrogen, and the electrolytic production of caustic and chlorine.—Lond. *Elec. Review*, June 4 and 11; Lond. *Engineering*, June 4 and 11.

Units, Measurements and Instruments.

Differential Methods for Measuring Hysteresis Losses.—R. Beattie and P. M. Elton.—The conclusion of this article, the first part of which was abstracted in the Digest last week. The authors give experimental results of the method described. Besides this method (which is a "single specimen" method) there are other possible ways in which the differential ballistic principle, as applied to hysteresis measurements, can be carried out. All these alternative methods, however, require the use of two exactly similar specimens and the duplication of the magnetizing coil. The simplest and most practical of these alternative methods is represented in Fig. 2. Two magnetizing coils, which must be wound with exactly the same number of turns per centimeter length, are in this case connected in parallel with equal resistances R_1R_1 in series. A resistance R_2 can be thrown into the circuit of either coil by means of the key K, which is an ordinary two-way key constructed so as not to break circuit in passing from one contact to another. As shown, the secondary coils wound round the test pieces are connected in series with the ballistic galvanometer G. To operate this method, K is placed in its mid position, which allows exactly equal magnetizing currents to flow through the two coils. The commutator C is then reversed a few times and stopped in its mid position. K is next set to one side and the commutator thrown over in the direction in which it was last moving. Lastly, K is thrown quickly over to the other contact, cutting R_2 out of the circuit and inserting it in the other. Provided the secondary coils are connected up so that the quantities induced by these two flux changes go in opposite directions through the galvanometer, the ballistic throw will measure δB. The special advantage of this method is that the induction changes take place simultaneously and not successively,

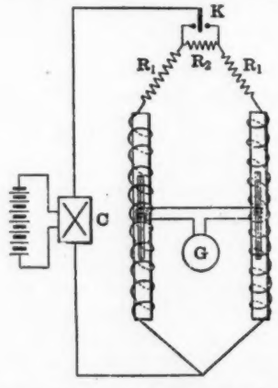


FIG. 2.—MEASURING HYSTERESIS LOSSES.

as, of necessity, they must in the "single-specimen" method. The key K may, therefore, be operated as quickly as one pleases; the key itself need not be of special construction.—Lond. *Electrician*, June 11.

Bifilar Vibration Galvanometer.—W. Duddell.—An abstract of a paper read before the Physical Society of London. The paper describes a new type of vibration galvanometer and a

series tests made upon it. Vibration galvanometers may be divided into two types: (1) those in which the moving part consists of a piece of iron and steel and the current to be measured flows round fixed coils as in the case of the Thomson galvanometer; (2) those in which the current to be measured flows round a moving coil placed in a fixed magnetic field on the syphon-recorder principle. The vibration galvanometers of Max Wien and Rubens belong to the first class, while Campbell's vibration galvanometer and the one described in the paper belong to the second. In the instrument described, the mass of moving parts is reduced to a minimum, the moving coil being reduced to the two wires forming its two sides, similar to a bifilar oscillograph, but with this difference: Whereas the bifilar oscillograph is designed so as to make the damping a periodic, the vibration galvanometer is designed so as to keep the damping as small as possible. A series of tests made upon the instrument showed that the total range of frequency was very large, namely, from 90 cycles per second up to 1900 cycles per second. The damping is very small, so that the resonance is very sharp. A series of measurements on the sensitiveness of the instrument showed that the sensitiveness to alternating current decreases very nearly inversely as the frequency for which the instrument is adjusted, whereas for direct current the sensitiveness decreases approximately inversely as the square of the frequency for which the instrument is adjusted, which is what usually takes place with direct-current galvanometers. The sensitiveness of the galvanometer for detecting small alternating voltages is reduced by the back e.m.f. of the instrument, and the paper concludes with a determination of the magnitude of the back e.m.f. in the instrument shown at the meeting. The advantages of the galvanometer are its simplicity, ease in tuning, wide range of frequency for which it can be tuned, high sensitiveness, negligible self-induction and comparatively small back e.m.f.—Lond. *Elec. Eng'ing,* June 10.

Interrupter.—J. REYVAL.—In the conclusion of his illustrated article on the recent exposition of the French Physical Society instruments of general physics and apparatus for therapeutic applications of electricity are described. Fig. 3 shows the in-

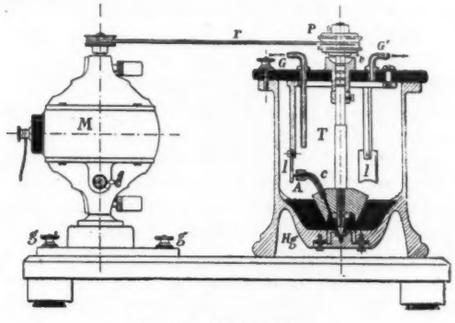


FIG. 3.—INTERRUPTER.

terrupter exhibited by a Paris firm. *M* is a small motor which drives the axle *T* of the interrupter. The latter contains mercury *Hg* in the bottom, which is sucked in and by means of centrifugal force is driven into the channel *c* and thrown out of the aperture *A,* so as to make contact successively with four metallic plates *l.* To prevent the deterioration of the mercury an inert gas is used in the apparatus entering through *G* and leaving through *g'*.—*La Lumière Elec.,* June 5.

Mercury Switch and Meters.—A note on a recent British patent of G. Hookham (13,215, 1908; June 3, 1909). In mercury motor meters it is necessary that the mercury should be in intimate contact with the metal armature, and it has been usual to coat the latter with a film of platinum and finally a film of a readily amalgamated metal, such as silver or copper. This outer film, however, has not proved satisfactory, as it comes off easily. According to this invention, a thin film of palladium is used over the platinum covering or direct on the metal armature. This readily amalgamates and lasts a long time. Such a film of paladium may also be applied to the contacts of mercury switches and other apparatus where intimate contacts between mercury and other material is required. It will adhere to carbon or insulating material.—Lond. *Elec. Eng'ing,* June 10.

Telegraphy, Telephony and Signals.

Wireless Telegraphy; New Telefunken System.—J. A. FLEMING.—An article on the new system of the Telefunken Company, the discharger being based on the known fact that the damping of very short sparks is extremely large, and that if we can "quench" or stop the primary oscillations after one or two swings the secondary circuit then continues to oscillate freely with a single period, as shown in Fig. 4. The discharger

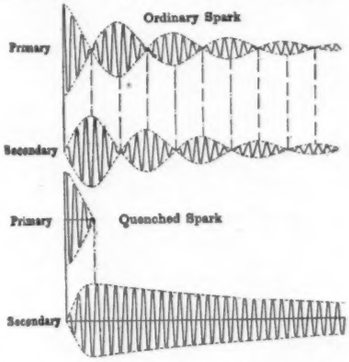


FIG. 4.—OSCILLATIONS IN INDUCTIVELY COUPLED CIRCUITS.

used in the experiments of the author consisted of 12 round flanged plates of copper, 5 in. in diameter, the surfaces being turned true and having a groove in them (see Fig. 5). A mica ring is interposed between each pair of copper plates of such size that the mica half covers each groove. This groove is important, for without it the discharge spark tends to take place always at the edge of the mica. The mica is of such thickness as to make an air space of not greater than 0.01 in. between the flat copper surfaces. In this discharger there are 11 air-gaps, each about 0.01 in. wide and of circular section. When this discharger replaces the ordinary spark-gap in the primary circuit it damps out instantly the primary spark, and hence excites the free oscillations in the secondary circuit "by shock"("Stosserregung" in German). In consequence of this rapid damping it is possible to employ an alternator having a frequency of 1000 to 2000 to create a corresponding number of

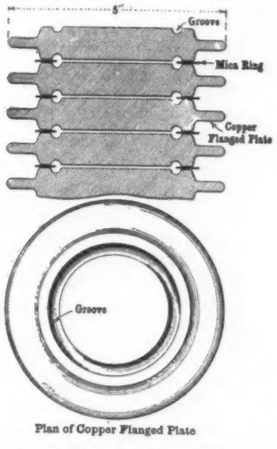


FIG. 5.—PLAN AND SECTION SHOWING PORTION OF DISCHARGER.

primary discharge sparks per second, without producing any true arc discharge. The rapid cooling of the discharge surfaces entirely prevents it. The rapid succession of highly damped primary sparks creates then an equally rapid succession of very feebly damped trains of oscillations in the secondary circuit having a very large mean-square value, and therefore possessing many of the properties of undamped oscillations generated without any true-arc effect.—Lond. *Electrician,* June 11. The same system is described at great length and with

many illustrations in an article by Count Arco, the first part of which appears in *Elek. Zeit.*, June 10.

Wireless Telegraphy.—A. S. M. Sörensen.—A paper read before the New Castle Section of the (Brit.) Inst. Elec. Eng. on the wireless telegraph station at Cullercoats. The installation comprises a "spark" apparatus with de Forest electrolytic receiver, as well as the more recently installed complete Poulsen "arc" equipment with which, by a photographic printing arrangement, messages have been received from Lyngby, in Denmark, at the rate of 100 words per minute. Fig. 6 gives the comparative power curves for arc and spark

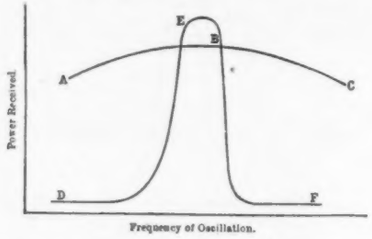


FIG. 6.—POWER CURVES FOR ARC AND SPARK EXCITATION.

excitation. The abscissas represent the frequency and the ordinates the power received; the relatively flat curve *ABC* refers to spark excitation, the curve *DEF* to arc excitation. A small variation in frequency produces large difference in power, rendering tuning or variation of frequency a good method of securing non-interference. Tuning to the extent of half of 1 per cent is possible by an arc working in an atmosphere of hydrogen. Frequencies of 100,000 per second are necessary for radiotelegraphic transmission by arc excitation, and the function of the hydrogen atmosphere is to bring the frequency above the maximum of 40,000 obtained with arcs working in air.—Lond. *Elec. Eng'ing*, June 10.

Wireless Telegraphy.—J. A. Fleming.—A Royal Inst. lecture giving a review of recent researches in wireless telegraphy. The author pointed out that there was very little absorption of the energy of the electric waves when they were traveling over sea water, which was a good conductor; but that over dry soil or rocks the waves penetrated deep, and there was much absorption. The multiple-gap transmitter of the Telefunken Company for general continuous oscillations was described, and the conditions for successful tuning were discussed.—Lond. *Elec. Eng'ing*, June 10.

Telephone Lines on Transmission Poles.—G. Laporte.—An article on the best methods of supporting a telephone line on the same poles which also carry a power transmission line. It is emphasized that the telephone line should be constructed just like a good power transmission line; that is, ordinary telephone insulation should not be used, but high-tension insulators, say, of 10,000 volts. The distance between the telephone wires and the power wires should be at least 1 m (3 1/3 ft.). The author also gives notes on apparatus advisable on such lines, repairs, etc.—*L'Industrie Elec.*, June 10.

Wireless Telegraphy.—J. A. Fleming.—When a radiating antenna in a wireless telegraphic station is coupled inductively and not very loosely to a spark-condenser circuit, it is well known that a compound radiation which may be resolved into waves of two wave lengths is radiated from it. If a corresponding receiving antenna is set up it is generally syntonized only to one of these wave lengths, and hence a considerable part of the radiated energy may not be absorbed by the receiver circuit. Such a system can be made more efficient if both the waves radiated simultaneously from the transmitter at the receiving end are absorbed. This can be done by employing two receiving sets coupled independently to one receiving antenna, as in Marconi's method for the simultaneous reception of two sets of signals, one of these syntonized to one of the wave lengths of the inductively coupled transmitting antenna and the other one to the second wave length. Associated with these two receiving sets a double-wound telephone should be employed, one circuit of which is in connection with the detector of one receiving set and the other with that of the other.—Lond. *Electrician*, June 11.

Miscellaneous.

Electrical Accidents.—A report of G. Scott Ram, the electrical inspector to the (British) Home Office Department, on electrical accidents in 1908. Although in many respects the report closely parallels that for the previous year, there is a marked increase in the number of electrical accidents in generating stations and substations, approximately 30 per cent; the number of fatal accidents in factories and workshops has increased in a still greater ratio, though the number of non-fatal accidents shows a fall of 14 per cent. It is hoped that the situation will be improved by the new regulations drawn up by the Home Office which are to go into effect in factories and workshops on July 1, and in electrical stations on Jan. 1. The inspector believes that nearly all the cases of bad and dangerous work and conditions that he has described and commented on in his annual reports are now covered by the regulations, and he confidently looks forward to more cheerful and reassuring reports in future years.—Lond. *Elec. Review*, June 11.

Electrical Industries in Continental Europe.—A review of the continental electrical industries and unfavorable prospects for the present year. Notes are given on various German, French, Belgian and Austrian manufacturing companies.—Lond. *Elec. Review*, June 4.

BOOK REVIEWS.

Elektromagnetische Ausgleichsvorgange in Freileitungen und Kabeln. By Karl Willy Wagner. Leipzig: B. G. Teubner. 109 pages, 23 ills. Price, 2.40 marks.

This little volume contains an elementary disquisition on electromagnetic waves and transitory disturbances in electric conductors, such as are used in practice. It is intended for advanced students of electrical engineering, being highly mathematical. A good presentation is given of the movement of waves to and fro along an electric circuit. The treatment is as simple as the present elementary condition of our knowledge on this subject permits.

Power Stations and Power Transmission. By George C. Shaad. Chicago: American School of Correspondence. 155 pages, 86 ills. Price, $1.

This manual describes approved American practice in the construction, equipment and management of electrical generating stations, substations and transmission lines. Descriptions are given of both steam and hydraulic plants, direct-current and alternating-current generators, transforming apparatus, transmission lines and distributing circuits. Theories are discussed only when a slight knowledge of theory is necessary to an understanding of the relative merits of several different arrangements. In addition to the descriptive matter, much information is given in the form of tables and diagrams. The book is suitable for self-instruction and home study, for which it was intended.

The Economy Factor in Steam-Power Plants. By George W. Hawkins. New York: Hill Publishing Company. 133 pages. Illustrated. Price, $3.

This book discusses the various types of steam engines and auxiliaries, with special reference to the steam consumption, also, numerous types of boilers as steam producers, and oil fuel as the source of energy. Its chief value lies in the large amount of specific information relating to the efficiency of engines, boilers, etc., which seems to have been compiled with exceptional care. The author has selected an analytical method of treatment, and the descriptive matter covers only those facts which have a bearing on the production or utilization of steam, no apparatus being described or illustrated. The presentation is in simple terms, and the information is arranged for immediate use by persons interested in the design of economical steam plants.

NEW APPARATUS AND APPLIANCES

Device for Photometric Comparisons.

The increasing use of high-efficiency tungsten lamps in connection with reflectors or shades has created a demand for some simple method by which the intensity of light derived from two sources can readily be compared. The average photometric measurement is not well adapted for use by a layman who does not care to know, as a rule, the intensity of a source of light or an illumination in terms of a standard, but simply desires a visual comparison which will indicate which source gives the brighter light without caring to know just how much brighter one source is than the other. To meet this condition, a simple, practical method of comparing the intensity of illumination has been worked out in the fixture branch of the Central Electric Company, Chicago, Ill.

The method is simply one of comparison, the two sources to be compared being located approximately as shown in the illustration, in which the intensity of the light reflected from one source is being compared with the intensity of the light reflected from another source. The usual practice is to mount two sockets and shade holders approximately 4 ft. apart on the ceiling of the fixture or display-room and equip each holder with the desired shade, care being taken to have the sockets connected to the same source of supply in order to operate the lamps under the proper voltage conditions. Care should also be taken to select lamps having approximately the same watt consumption in order to secure a fair comparison.

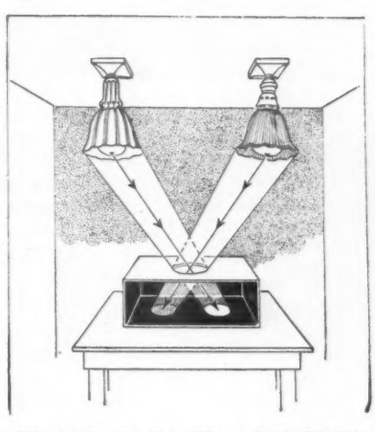
The measuring or comparison device is placed on a table and consists of a rectangular box provided with a round hole in the top, this hole being so located that a ray of light emitting from either of the lamps will throw a light spot on the horizontal shelf on which is placed a piece of white paper. One side of the box (see cut in next column) is left open so that an observer can readily see the interior. With two sources of light located as shown in the diagram, two light spots are thrown on the white paper, and it is a very easy matter to select the brightest spot. It should be remembered that the light rays cross; that is, the light from the left lamp is thrown at the right-hand side of the measuring device, the light from the right being thrown at the left-hand side of the measuring box when facing it.

The Compensarc.

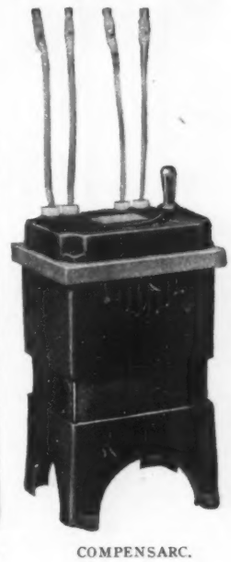
Some kind of a device for controlling arc lamps on moving-picture machines is necessary for the reason that moving-picture machine arc lamps operate at approximately 35 volts at the arc, while the voltage obtainable from practically all commercial lighting circuits is either 110 volts or 220 volts. Formerly iron-wire or grid resistance rheostats were used, but these result in a waste of all that energy supplied from the line over and above that actually required by the lamp. The Fort Wayne Electric Works is placing on the market a special type of adjustable auto-transformer known as the "Compensarc," which insures in this service a great saving in power, with, it is claimed, a superior quality of light in color, intensity and stability. The device is rated at 2 kw for 110 volts or 2½ kw for 220 volts, and wound for either 60 cycles or 133 cycles. The general appearance of the "Compensarc" is shown in the illustration. The core is made of the highest grade sheet-steel laminations, similar to standard transformer construction. The outer surface of the core is fully exposed to the air. The coils are mounted within the core and are completely protected and thoroughly insulated. The core and coils are given vacuum treatment, making them moisture- and water-proof.

The assembled core and coils are supported by a cast-iron base having four legs which hold the device at a convenient height from the floor. The case is also of cast iron and rests on the top of the core. It is liberally ventilated and encloses the ends of the coils and protects the connections on the inside. A slate top supports the switch blade and clips; a long, heavy bolt passes through each corner of the slate case and base outside the core, thus holding these parts together firmly.

A horizontal, three-step, continuous circuit switch is mounted on the slate top, providing three adjustments for intensity of light. Each adjustment is so designed that it maintains approximately the same voltage at the arc while passing from one step to the next, without at any time opening the circuit, which would break the arc and produce flickering. There is no waiting for the arc to settle and become steady before the intensity of the light can be determined. A cast-iron cover over the slate top completely encloses the switch blade and contacts, making it impossible for accidental short circuits to occur, and also removes all danger to the operator. The terminals to the line and lamp are brought out through porcelain insulators in the cover. The lamp terminals are plainly designated, and with a little care the "Compensarc" can be installed by any operator.



DEVICE FOR PHOTOMETRIC COMPARISONS.



COMPENSARC.

The device is approved by the National Board of Fire Underwriters, there being no fire risk attached, as no noticeable rise in temperature occurs even after several pictures have been run through the machine. The "Compensarc" cannot be short-circuited. Even though the switch blade is at an intermediate point and thus bridging two adjacent contacts, it will not burn out. The adjustments possible with the "Compensarc" are very essential to successful moving-picture work, and the fact that the "Compensarc" provides these adjustments without breaking the circuit and putting out the light makes it all the more desirable. It is claimed that the "Compensarc" saves 66 2/3 per cent on light bills for moving-picture arc lamps.

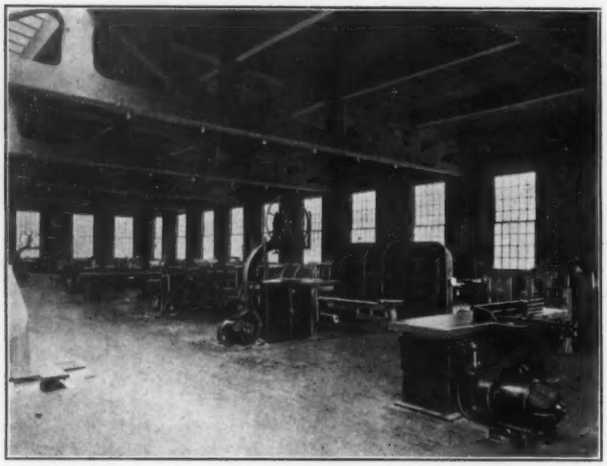
Electric Motors in a Pattern Shop.

One of the best installations of electrical apparatus in a pattern shop in western Pennsylvania is located at West Homestead in the works of the Mesta Machine Company. The two floors of a reinforced concrete building are devoted exclusively to the pattern shop, giving it an exceptionally favorable location in every respect. The natural light is excellent, the machines are all driven by individual motors so that there are no overhead belts, and the wiring is entirely concealed, making the

general appearance of the shop particularly clean and attractive.

The shop is equipped throughout with new machinery suitable for the preparation of the patterns required for the large engines and rolling mill machinery manufactured by this company, and everything is modern and up to date in the equipment. An idea of the general layout of the shop is given in the illustrations. One of these shows the shop floor cleared of work, while another photograph was taken with patterns of various descriptions in different states of completion.

The equipment includes three bench saws, three band saws, a swing saw, three surfacers, three jointers, three lathes, a pony planer and a pattern scroll saw. Each machine is driven by its own motor, either belted or, in a few cases, as with the two-speed lathes, direct connected. The planer and the surfacers are driven by a countershaft to which the motor is direct connected. The motor for the scroll pattern saw is directly coupled to the crank wheel, providing a most compact equipment.



FIGS. 1 AND 2.—INTERIOR OF ELECTRICALLY EQUIPPED PATTERN SHOP.

The capacities of the motors, and the machines to which they are connected, are given in full in the accompanying table. It is to be particularly noted that the motors are largely 3½ hp or 5 hp. This is due to the fact that it was desired to secure as many motors as possible of one size in order to keep the repair parts carried in stock a minimum. These 5 hp motors, running at 1600 r.p.m., and the 3½ hp motors, running at 1050 r.p.m., are built on the same frame, and all parts, except armatures and field windings, are interchangeable. Spare armatures and field coils of each type are kept in stock in readiness for any accident. These motors are of the direct-current, 220-volt, shunt-wound type.

PATTERN SHOP INSTALLATIONS.

Machine			Motor	
Type.	Make.	Size.	Hp.	Speed.
Cut-off saw	Oliver	No. 60, 14 in.	5	1600
Cut-off saw	Oliver	No. 60, 14 in.	5	1600
Rip saw	Oliver	No. 60, 14 in.	5	1600
Surfacer	Oliver	No. 61,	5	1600
Surfacer	Oliver	24 in. x 9 ft.	5	1600
Jointer	Oliver	B, 20 in.	5	1600
Jointer	Oliver	B, 20 in.	5	1600
Jointer	Oliver	24 in.	5	1600
Lathe	Oliver	B, 30 in.	5½	450-1350
Speed lathe	Oliver	12 in.	¾	500-1500
Speed lathe	Oliver	No. 24, 20 in.	2	500-1500
Bank saws	Oliver	36 in.	3½	1050
Bank saws	Oliver	36 in.	3½	1050
Bank saws	Oliver	36 in.	3½	1050
Swing saw	Oliver	No. 36, B	3½	1050
Pattern scroll saw	Oliver	No. 1,	¾	*700
Pony planer	Fay & Egan	24 in.	5	1600
Surfacer	Towsley Mfg. Co.		5	1600
Saw filer	Black Diamond Mach. Wks.	6 in. x 40 in.	3½	†1050
Knife grinder	Oliver			

* Direct connected. † Group drive.

To prevent damage to the commutator by the accumulation of dust and dirt, the electrical superintendent, Mr. F. G. Galbraith, has devised a neat wire covering which affords ample ventilation and yet prevents the shavings, etc., from getting inside the motor. Protection to the belts from dirt, etc., and to the operator in case of a broken belt, is afforded by a special steel guard which is fastened to the floor and to the motor frame, and completely encloses the belt. This device, made by the Mesta Machine Company for this purpose, is shown in the illustrations.

The wiring is all carried in an 8-in. conduit in the floor, which runs the full length of the shop, with outlets at each machine. This conduit is packed with kiln-dried silica sand which absolutely prevents any possibility of arcing or fires. The switchboard is in a separate room where the saw filing and knife grinding are done by an automatic filing machine, which is so arranged that the band saws may be loosely looped over an old band saw wheel.

In addition to the motor there are nine glue pots, electrically heated, where all the glue is warmed. Practically the entire motor equipment, together with the glue pots, was supplied by the Westinghouse Electric & Manufacturing Company.

New Hydraulic Jacks.

Anyone who has much heavy lifting to do appreciates that there are pleasanter tasks than carrying around a jack from one place to another, especially when it weighs more than 100 lb. It means rather a heavy load if carried by hand, and if the jack is loaded on a truck and reloaded with each using, this also involves considerable work.

The new Watson-Stillman shop jack, shown in Fig. 1, was designed to render unnecessary much of this labor. This jack, made in 11 sizes, of from 20 to 50 tons capacity and for lifts of 12 in. and 18 in., fills all the ordinary requirements of lifting heavy machinery and for general shop work. The wheels on the base and the handle on the cylinder facilitate moving the jack quickly from one place to another without the exertion of a great deal of work. The wheels touch the floor only when the jack is tilted, so they are never in the way during the lifting operation. If it is desired to use the jack at an angle, it can be tilted in the opposite direction to the wheels; and when it is laid flat upon the side, the ram will push out its entire lifting length. The head is enlarged sufficiently that the jack will not stop working for lack of filling, even if there has been slight leakage. An independent steel claw (not shown in the illustration) can be used when desired for lifting from near the ground. This is more convenient than a permanently attached claw, as the independent part is easily applied when a low lift is required, and its removal at other times allows the jack to be made of considerable lighter weight. The weight, however, is comparatively small, as the whole jack is made from steel, and the parts under greatest strain, such as the ram and cylinder, are machined from a solid bar of higher carbon steel than usually found in hydraulic or other jacks.

It is sometimes inconvenient to work the lever of a jack of the internal pump type because of the lack of room, or insufficient footing. There are other places where only a short space is available to place the jack, a condition which cannot be met successfully with the ordinary inside pump jack. To meet these conditions the Watson-Stillman Company has put on the market the independent pump hydraulic jack shown in Fig. 2, in 53

FIG. 1.—SHOP JACK.

sizes of from 2 to 1200 tons capacity. The various sizes of the jack proper have maximum ram movements of from 4 in. to 8 in. The pump is connected to the jack by means of flexible copper tubing, which may be of any length suitable to the work in question. The jack may be operated up to a pressure of 450 lb. per square inch on the ram by means of the hand lever shown on the pump, and further worked to full capacity by means of the extension lever. The gage may read in pounds

FIG. 2.—INDEPENDENT PUMP HYDRAULIC JACK.

per square inch, or in tons load upon the jack, or both. This is not furnished when the jack is to be used for ordinary lifting, but is necessary in testing. When equipped with the gage, the jack may be used between two fixed platens for making compression tests, testing the tightness of forced fits, etc. Both of the above jacks are made by the Watson-Stillman Company, of New York.

A Large Telephone Cable.

On Tuesday, June 8, the Western Electric Company shipped the first sections of submarine telephone cable designed to connect San Francisco with Oakland, by way of Goat Island, beneath the waters of San Francisco Bay. The cable is 2⅞ in. in diameter, containing 69 pairs of telephone wire—26 pairs of No. 13 and 43 pairs of No. 19 conductors. On the big reel the first section, 4250 ft. in length, weighed 26½ tons.

The truck on which this cable was hauled weighed about 5 tons, and 16 horses dragged the heavy load. The wagon was built very low, with a clearance of only 8 in. between its lowest part and the ground. Guiding eight teams of horses through the streets of New York and around the narrow corners is an unusual sight as well as a difficult task, and many stared at the cavalcade as it made its way along Bethune Street from West Street to Eighth Avenue, thence up to Twenty-seventh Street and west to the river, where the freight dock of the Lehigh Valley Railroad is located. The second consignment of 4250 ft. left the Western Electric Company's factory in the same manner two days later.

The first two sections of this cable, 8500 ft. altogether in length, are to extend from San Francisco to Goat Island. When the other two sections of 7800 ft. arrive, they are to be stretched from the island to Oakland Mole. On Goat Island connection with land cable is to be made. The entire 16,300 ft. of cable is one of the largest orders for paper-insulated submarine telephone cable ever placed. The cable is consigned to the Pacific Telephone & Telegraph Company.

Condenser-Lead Circuit Breaker.

The Westinghouse Electric & Manufacturing Company has developed and placed on the market a heavy-capacity oil circuit-breaker, which is made for voltages of 44,000, 66,000, 88,000 and 110,000. This new type consists of single-pole units, each enclosed in its individual boiler-steel tank with separate operating mechanism, leads, etc. All the operating parts are mounted on the cast-iron top, and are operative on the top so that the mechanism may be lined up before it is dropped into the oil tank. Eye bolts are provided for handling the top as a unit. Since the connection between poles is simply a piece of ¾-in. gas pipe, the poles may be spaced any convenient distance apart. The pipe is used as a pull rod, being in tension only. It is impossible for the different poles to stick due to improper alignment, as they may be placed several inches out of line without making the angle of pull sufficient to jam the mechanism.

The breaker may be either hand- or solenoid-operated, and of any number of poles. The automatic circuit-breaker is furnished either for use with series transformers or with a self-contained series trip. Time-limit features may be incorporated if desired.

The breaking capacity is practically unlimited, the heavy boiler-steel tanks and cast-iron top giving strength against internal pressures. The total travel of the moving contacts is large, there being two breaks in series at each pole. Each break takes place in a separate compartment, separated from the other pole by double barriers of insulated material. The break is between brass and copper, materials which have been found to give the best protection against burning. Each moving contact piece has its own heavy steel spring to take up any wear due to arcing, and slides across the stationary piece with a rubbing motion, keeping the contacts bright. The insulation features of this breaker are stated to be probably superior to those of any device of its character ever designed. While this is in a great measure due to the condenser type of lead, as will be explained, in any type of apparatus the insulation is dependent on the number of paths to ground, or, in other words, the number of insulation points. It will be noted that in this form of circuit-breaker there are only three such points: namely, the two leads and the wooden rod. The rod being of moderate cross-section, can be easily and thoroughly dried and impreg-

nated, and is well immersed in oil at all times, so that its factor of safety is large.

The condenser type of lead used is claimed to be probably the greatest advance in high-tension work that has been made for some time. The problem of carrying a high-tension conductor through a grounded surface has been one of the limiting factors in developing higher voltages. Due to the fact that it was impossible to maintain the same stresses in all layers of insulating material, on account of the unequal distribution of potential in

FIG. 1.—60,000-VOLT OIL CIRCUIT-BREAKER, OPEN.

them, excessive amounts of insulation were required to secure safety. It was even found necessary to remove all grounded material from the neighborhood of the conductor, and various further makeshifts have been used, such as oil-filled terminals, double or triple porcelains, and excessive amounts of varnished cloth or paper. In the Westinghouse type of breaker for 66,000-volt transmissions, which provides protection for both the Niagara and Southern Power company lines, heavy soapstone

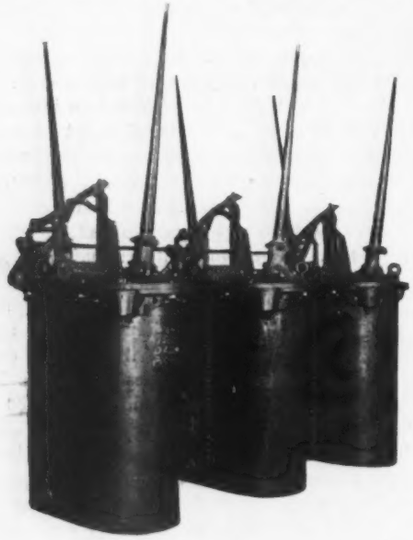


FIG. 2.—60,000-VOLT, THREE-POLE OIL CIRCUIT-BREAKER.

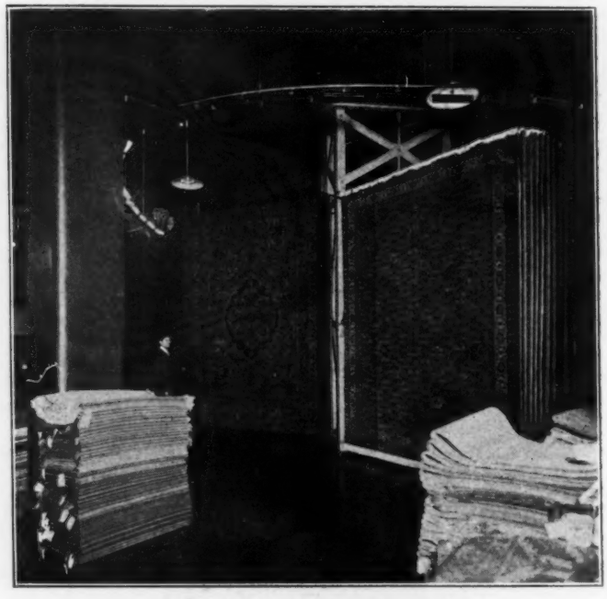
tops, varnished cambric leads, and expensive and cumbersome porcelains were required. The contrast with the new type is surprising. A moderate-sized lead made up of alternate layers of tinfoil and insulation is fastened solidly into cast-iron flanges, and at voltages far in excess of that required to break down former construction, these leads show no static discharge or other evidences of strain.

The development of this condenser lead has been carefully worked out, expensive machinery for producing it having been installed, and every point in connection with its manufacture is stated to be thoroughly covered by patents. That this breaker is appreciated is shown by the fact that the Westinghouse company has supplied, or has orders at the present time, for over 200 single-pole units for 44,000-volt, 66,000-volt and 110,000-volt lines, and has other large orders in immediate prospect.

Linolite Lighting in a Rug Store.

In a large Wabash Avenue rug store, in Chicago, there is an interesting example of linolite tubular lighting applied to the illumination of rugs vertically displayed on a frame with horizontal arms in the manner illustrated. The rugs shown here are domestic rugs. The Oriental rugs are displayed on the floor in the front part of the store under four-light and five-light clusters of 60-watt tungsten lamps on Federal electric fixtures having inverted cones of opalescent glass suspended from the ceiling by chains.

In the rear of the store is a strongly built framework supporting 72 movable arms at a height of about 13 ft. from the floor. These arms are pivoted in a strong metal plate fastened to the principal supporting column of the framework and they



LINOLITE LIGHTING IN A RUG STORE.

are suitably braced to hold up the heavy rugs. From the top of each arm two rugs are suspended, back to back. The capacity of this display device, which is illustrated herewith, is 144 rugs 9 ft. x 12 ft. in size. The arms are revolvable in a half-circle about the central support, and thus the rugs may be shifted for inspection something like the leaves of a book.

To light these vertically displayed rugs there is arranged in a semicircle just above the level of the rugs 20 sections of linolite tubing, each provided with a suitable reflector, as shown in the picture. Each section is provided with a straight, horizontal 16-cp carbon filament; but as the light from every part of the filament is exactly focused by the reflector, it is said that each of the 20 units gives an equivalent of 40 cp. Each section is about 1 ft. long, and the arrangement approximates one long incandescent filament, extending in a half-circle above the rugs, the light being directed just where needed by the reflectors. Mr. Pushman, of Pushman Brothers, who own the rug store, says that this form of rug lighting is very satisfactory. It is interesting to note that the H. W. Johns-Manville Company, which makes "linolite," is experimenting with tungsten filaments in its horizontal tube lamps, and apparently with good chances of success.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Continued improvement has been shown in all branches of trade during the past week. This is largely due to better weather and to the improved condition of crops. At this, the most critical period for crops, the conditions are regarded as eminently satisfactory. Reports from retailers are still irregular, and the excessive heat is credited with retarding trade in some sections. Clearance sales are being used all over the West in order to stimulate distribution. The jobbers and wholesalers report a slight improvement in reorders, and numerous inquiries for next fall and spring delivery. The industrial business, led by iron and steel, continues to show expansion of operation, and in many places advances in wages. More men are being employed in almost every line, and there is great confidence for the future. The noteworthy feature of the week was the purchase of 135,000 tons of steel rails by the Harriman system; 80,000 tons of this went to mills in the Chicago district. The railways are in the market for cars and liberal orders are expected in the near future. Building continues to be active almost all over the country, but is still largely of the steel and concrete type. Railway earnings show large improvements over those of last year and rolling stock is now fairly well employed on all sides. Collections continue to be only fair, but there is little pressure being exerted by creditors. Business failures for the week ended June 24 were 225, against 213 for the previous week, 258 in the same week of 1908, 150 in 1907, 146 in 1906 and 186 in 1905.

THE COPPER MARKET.

There has been considerable speculative buying of copper during the past week and some takings by domestic consumers. About 10,000,000 lb. was taken within a few days, resulting in a slight advance in electrolytic and casting grades. Carefully prepared statistics show that there came to light in this country from Jan. 1 to June 1 marketable copper to the amount of 687,182,382 lb., which includes the stock on hand at the beginning of the year. Deliveries during that time were 517,334,241 lb., leaving stocks June 1 at 169,384,141 lb., an increase in the five months of 47,490,875 lb. In addition to this it is very well known that the takings by Europe have vastly exceeded the consumption and that the warehouses of both England and the Continent are loaded down. The purchases in the United States are also believed to be far in excess of the actual consumption, indicating heavy accumulations for future business. For instance, domestic takings in May were 61,300,000 lb., considerably more than was ever used in one month at the highest period of business boom. These figures do not indicate any material advance in prices. Exports continue to be very heavy, being for the month of June, up to and including June 28, 31,975 tons. Quotations on the Metal Exchange on the same date were:

Lake	13¼ @ 13½
Electrolytic	13 @ 13⅛
Casting	12¾ @ 13

The London prices June 28 were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	58 17 6	59 2 6
Standard copper, futures	59 15 0	60 0 0
Market	Weak	Steady
Sales of spot		200 tons
Sales of futures		1,800 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

MILWAUKEE WESTERN ELECTRIC RAILWAY.—The preliminary work of the new Milwaukee Western Electric Railway Company has now proceeded so far that a brief statement of the objects of the enterprise can be made. The company has its headquarters in Milwaukee with an office in the Majestic Building. Its president is Val. Zimmerman, Jr., who is also president of the Mitchell Street Bank of Milwaukee. The engineer retained by the company is C. A. Chapman, Inc., 204 Dearborn Street, Chicago. An electric railway will be built in a general northwestern direction from Milwaukee to Beaver Dam, Wis., having a total length of main line and branch of 68 miles. It will pass through the villages and towns of Butler, Templeton, Sussex, Merton, North Lake, Alderly, Neosho, Hustisford and Juneau. Connecting with the main line at Sussex there will be a branch extending in a southern direction through Pewaukee to Waukesha. The surveys for the line are just being completed, and construction will probably be begun within the next three months. The general engineering characteristics, such as overhead or third-rail construction, kind and voltage of current to be used, are now under consideration. A general contract for the construction of this railway has been awarded to the Chapman Company, of Chicago.

McGRAW-HILL BOOK COMPANY.—The book departments of the McGraw Publishing Company and the Hill Publishing Company have consolidated under the corporate name of the McGraw-Hill Book Company, with offices after July 1 at 239 West Thirty-ninth Street, New York. This consolidation brings together two of the most active publishers of technical books in the country. The new company takes over the book departments of both houses with a list of about 250 titles, both industrial and college text books, covering all lines of engineering. It will continue as well the retail, importing and jobbing business of the two houses. The officers of the new company are as follows: President, John A. Hill; vice-president, James H. McGraw; treasurer, Edward Caldwell; secretary, Martin M. Foss. Mr. Hill is head of the Hill Publishing Company, which controls the *American Machinist, Engineering and Mining Journal, Power and the Engineer.* Mr. McGraw is head of the McGraw Publishing Company, which issues the *Electrical World, Electric Railway Journal* and *Engineering Record.* Mr. Caldwell has been manager of the McGraw book department for several years and Mr. Foss manager of the Hill book department.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in the present issue are announcements of proposed new plants or considerable extensions of present plants at Waterbury, Conn.; Methow, Wash.; Brazil, Ind.; McKurtain, Okla.; Denver, Col.; Fulton, N. Y.; Orange, N. J.; Post Falls, Idaho; Madisonville, Ky.; Spring Valley, Ill.; Franklinville, N. Y.; Lowell, Mass.; Binghamton, Tenn.; Antigo, Wis.; Seymour, Ia.; Zionsville, Ind.; Des Moines, Ia.; Hyrum, Utah; Toronto, Ont., Can.; Kenosha, Wis.; Valley View, Ky.; Columbus, Ga.; Hawkinsville, Ga.; Lone Wolf, Okla.; Sinton, Tex.; Bartlesville, Okla.; Brookneal, Va.; Camp Hill, Va.; Crosbyton, Tex.; Quincy, Fla.; McMinnville, Ore.; Middletown, Conn.; Glendale, Cal.; Benson, Ariz.; Kankakee, Ill.; Jacksonville, Fla., and Philadelphia, Pa.

BUFFALO ELECTRIC PUMPS.—Owing to trouble with the third electric pump equipment for the Buffalo water works, which has extended over some months, two steam pumps have been ordered for further extension of the pumping service. The trouble has been entirely due to various defects in the design and construction of the centrifugal pump part of the unit, but as the frequent notices in the newspapers as to deficiencies always referred to the "electric pump," electric pumping service as a whole has locally lost in confidence.

GERMAN ELECTRICAL ENTERPRISE IN CHINA.—A consular report from China speaks of the activity of a German in Berlin in a campaign for selling central station plants in China. The firm has opened branches in a number of Chinese cities where sample plants, lines of electrical supplies, etc., are kept. Plants recently installed are as follows: At Kirin, two 165-kw, 5000-volt, direct-connected, three-phase units; at Soochow, two 175-kw, 2200-volt, direct-connected, three-phase units; at Mukden, a 350-kw unit.

INTERBOROUGH MAKES LARGE EQUIPMENT CONTRACTS.—The Interborough Rapid Transit Company, New York, has placed its contracts for the equipment of the 350 new cars which were ordered some weeks ago. It has contracted with the General Electric Company for 380 200-hp motors for the equipment of 190 new steel cars for the subway, and also for 190 equipments of control for the same cars. In addition, the General Electric Company will supply 40 equipments of control for elevated motor cars, 60 trailer equipments for the subway and 40 trailer equipments for the elevated. The Interborough company also bought from the Westinghouse Electric & Manufacturing Company 120 125-hp motors for the equipment of 60 elevated cars, and 20 equipments of control for these cars. The steel cars are being made by the American Car & Foundry Company, Standard Steel Car Company and the Pressed Steel Car Company. The wooden trailer cars for the elevated are being built by the St. Louis Car Company and the Wasson Manufacturing Company. The motor cars for the elevated are divided, 20 to the Jewett Car Company, of Newark, Ohio, and 40 to the Barney & Smith Car Company, Dayton, Ohio. In addition to these purchases for car equipments, the Interborough has contracted with the Westinghouse Electric & Manufacturing Company for the building of two 3000-kw, three-phase rotary converters, and six 1100 kv-amp, single-phase transformers. It is stated that one of these sets is for substation No. 6, and the other for substation No. 7. The steel cars, which will be of the side-door pattern, ordered by the Public Service Commission, will be delivered, about one-half during the fall and the balance next spring. The trailers and elevated cars will be delivered in September. This total order for car equipments is one of the largest recently placed, and altogether will amount to something like a million dollars, of which the General Electric will receive 75 or 80 per cent.

BUSINESS OF THE ELECTRICAL COMPANIES.—A review of the business now being done by the General Electric Company and the Westinghouse Electric & Manufacturing Company, made by a New York financial paper, estimates that in 1909 the former will do a business of about $53,000,000, and the latter a business of about $25,000,000. Speaking of the present condition of these companies, the review says: "The General Electric and Westinghouse companies are now well fortified from the standpoint of working capital, and they can engage in large enterprises without assistance from banking institutions. As an illustration, the General Electric Company on Jan. 31, last reported cash holdings of $22,234,000, which is almost twice the amount held the year previous. The company has a working capital of approximately $57,000,000. The Westinghouse Electric & Manufacturing Company, as a result of the reorganization, is stronger from the standpoint of cash and working assets than at any time in its history. It recently reported cash holdings of close to $13,000,000." The General Electric Company, it is stated, now has a floor space of 7,000,000 sq. ft., and employs 23,000 hands.

CUTLER-HAMMER BUYS SCHUREMAN COMPANY.—An official announcement has been made by the Cutler-Hammer Manufacturing Company, of Milwaukee, that it has purchased the plant, business and patents of the J. L. Schureman Company, of Chicago. The latter concern manufactured the Schureman controlling apparatus and other electrical appliances. The manufacture of this apparatus will be continued, and all agreements and contracts will be carried out by the purchasers. It is also announced that S. M. McFedries, who has been general manager of the Schureman Company, has been retained by the Cutler-Hammer Company, and will remain in active charge of the manufacture and sale of Schureman apparatus. J. L. Schureman retires from the business. Until further notice the Schureman Company will retain its old address, 70 West Jackson Boulevard, Chicago.

NEW WESTERN CONSTRUCTION CONCERN.—The Chapman Company, of 204 Dearborn Street, Chicago, has been incorporated recently to make investigations and reports and to design and construct steam railways, electric railways, public service systems, private industrial plants and the like. The officers of this new company are: President, W. D. Chapman; vice-president, H. W. Davis; secretary and treasurer, J. H. Adams. The Chapman Company has entered into a contract with C. A. Chapman, Inc., by which the latter concern will do all of the engineering for the former. The two corporations are not further related, however, although W. D. Chapman, the president of the Chapman Company, is the father of Charles A. Chapman, president of C. A. Chapman, Inc. The Chapman Company has in hand the construction of a steam railroad in Mexico and a new electric interurban line in Wisconsin.

ELECTRICAL SUPPLIES FOR ISTHMIAN CANAL COMMISSION.—The general purchasing officer for the Isthmian Canal Commission invites sealed proposals in triplicate for a quantity of electrical supplies to be furnished by steamer free of all charges on the dock at either Colon or Port of Ancon, Isthmus of Panama. There are 59 items of lighting material to be used for the berm and chamber cranes, Pedro Miguel and Miraflores locks and Ancon crushing plant, embracing loricated conduit, fittings, wiring and accessories. Lightning arrester equipment and cable are required at the Pedro Miguel substation and railway material to be used for third rail and feeders at Pedro Miguel and Miraflores for the berm and chamber cranes. Bids must be received not later than 2.30 p. m. on July 6 at the office of the commission in Washington.

SUITS AGAINST CONDUIT COMPANIES.—Francis K. Pendleton, corporation counsel for the city of New York, has filed suits in the Supreme Court against the Consolidated Telegraph & Electrical Subway Company and the Empire City Subway Company for the recovery of $4,348,686, which he alleges the city has been defrauded out of by means of false accounts and reports. He also demands a detailed accounting to show the actual cost of the subway, for which the city paid $12,388,519. The two companies recently entered a claim against the city for $8,000,000 alleging that this sum represented the loss sustained in the operation of the subways since 1899. It was this claim which caused the city's attorney to start an investigation the result of which is the present suit.

HUDSON TUNNELS TO OPEN JULY 19.—W. G. McAdoo, president of the Hudson & Manhattan Railroad Company, has announced that the downtown tunnels, which run from the Hudson Terminal Building, in Manhattan, to the Pennsylvania Railroad station, at Jersey City, will be opened at 3 o'clock on the afternoon of July 19. An elaborate celebration will be held in Jersey City at this time. The entire tunnel system, which extends from the Pennsylvania station north to the Erie and Lackawanna stations, joining the uptown tunnel, will be, it is said, ready for operation on July 19, but the inability to secure sufficient cars from the builders will delay the opening of this branch until August 2.

ELECTRICAL PROMOTION IN TURKEY.—The Department of Commerce and Labor has received information from the consul at Brunswick that a German-French combination has recently been formed for the purpose of promoting electrical enterprises in Turkey. A number of French, German, Belgian and Swiss banks have joined the combine, and it is said that the syndicate is under the leadership of the Deutsche Bank of Berlin. This institution is closely allied with the Siemens-Schuckert Company.

BUSINESS REVIVAL IN THE WEST.—Reports from Chicago say that buyers of electrical apparatus are not only talking in a more encouraging way, but they are actually making purchases of machinery and supplies in considerable quantities. One indication of the truth of this statement is the fact that, during the month of June, 11 turbo-generator sets of good size were sold by the Chicago offices of the Westinghouse Electric & Manufacturing Company and the Westinghouse Machine Company.

HARVARD STADIUM "JOAN OF ARC" ELECTRICAL INSTALLATION.—The electrical apparatus used in the remarkable production of "Joan of Arc" in the Harvard Stadium, an account of which was printed in these pages last week, was supplied by the Rossiter-MacGovern Company, New York.

WESTCHESTER LIGHTING MERGER APPROVED.—The Public Service Commission of the Second District of New York has granted permission to the Westchester Lighting Company to purchase the entire $804,000 capital stock of the Northern Westchester Lighting Company, and the $90,000 par value of its first consolidated mortgage bonds at a price not to exceed $81,000, and also to purchase the $500,000 of common stock of the Peekskill Lighting & Railroad Company, and 750 shares of the company's 6 per cent cumulative preferred stock at a price not to exceed $75,000. The commission says in its opinion that the turning of the control of these properties over to the Westchester Lighting Company will result in su-

perior facilities, in that the plant of one company will thereby become serviceable to the other company, and that the demand for increased service in the territories supplied by these companies may more readily be met. The Westchester Company is also authorized to issue first collateral trust bonds to the par value of $580,000, to mature in 10 years, bearing 5 per cent, and the proceeds of these bonds are to be used in acquiring the stock issues.

Financial Intelligence.

THE WEEK IN WALL STREET.

At the beginning of last week there was a rather sharp bear attack made upon stocks in Wall Street, which was the culmination of a downward market which had lasted for a fortnight. From a practical point of view the attack was a failure, and its most prominent result was that it brought out strong support which gave the market an important upward tendency, and accentuated the buoyant feeling that had existed throughout the spring and early summer. Trading, while not very heavy, was always with the advantage on the buying side, and the result is that during the week there have been marked recoveries in all of the important and active issues. Such depressing rumors as the bears could command; Harriman's ill health, the corporation tax and our old friend "crop damage," had practically no effect on general market conditions. There is a disposition to buy stocks, both by professional traders, and, more cautiously, by outsiders. The amount of stock for sale is apparently limited, and under such circumstances any continued depression is impossible. It is not often that the stock market is as strong in tone and as persistently elastic at this season of the year as it is to-day. The demand for bonds continues to be one of the remarkable features of the financial world. There seems to be no end to the amount of money that is ready to be invested in good securities, and all issues are eagerly sought by underwriting syndicates and financial houses. Good industrial and railway securities are being oversubscribed at prices that will net the purchasers barely 5 per cent, and this in reality is the most substantial feature of the entire security situation. Money continues to be remarkably cheap, and, in spite of exports of gold, very plenty. Quotations June 28 were: call 1¾ @ 2 per cent, 90-day 2¼ @ 2¾ per cent. The quotations in the table are those of the close June 28.

NEW YORK.

	June 28.	July 5.	Shares Sold.		June 28.	July 5.	Shares Sold.
All.-Ch.	15¼	15⅛*	600	Int.-Met., pfd.	44⅝	52	110,050
All.-Ch., pfd..	51⅞*	51½	1,800	Mackay Cos..	79½	81*	2,650
Amal. Cop....	78⅜	81	131,270	M'c'ky Cos., p.	74*	74½*	——
Am. D. T....	29*	29*	——	Man. Elev....	143	143⅞*	225
Am. Loc.....	58⅛	59¼	16,310	Met. St. Ry..	27	25⅞*	762
Am. Loc. Pfd.	117¾*	117¾*	120	N.Y.&N.J. Tel.	129	137*	320
Am. Tel.&Cbl.	80*	80*	——	Steel, com....	64¼	66¾	519,676
Am. T. & T..	140½	142	14,750	Steel. pfd.....	121	124⅜	28,625
B. R. T.....	77¼	79⅝	26,190	W. U. T.....	72⅝	72	8,600
Gen. Elec....	160	161½*	3,200	West'h, com...	83	85	5,111
Int.-Met., com.	15¾	17	44,050	West'h, pfd...	121*	121*	——

PHILADELPHIA.

	June 28.	July 5.	Shares Sold.		June 28.	July 5.	Shares Sold.
Am. Rys.....	45½*	45¾*	——	Phila. Elec...	11⅜*	11¾	——
Elec. Co. of A.	12⅜*	12⅜*	——	Phila. R. T...	28⅜	28	——
Elec. St. B'ty.	53½	52⅜*	——	Phila. Trac...	91*	91*	——
E. S. B'ty, pfd.	49*	49*	——	Union Trac...	52	52⅛	——

CHICAGO.

	June 28.	July 5.	Shares Sold.		June 28.	July 5.	Shares Sold.
Chi. City Ry..	180*	180*	——	Chi. Tel. Co...	132½*	134*	——
Chi. Rs., Ser.1.	107*	107*	——	Met. El., com.	19*	17½*	——
Chi. Rs.,Ser.2.	36½*	37⅜	——	Met. El., pfd.	54*	50*	——
Com. Edison...	118	119½	——	Nat'l Carbon..	93*	92	——
Chi. Sub'ws...	24⅛*	24*	——	Nat'l C., pfd..	118*	117*	——

BOSTON.

	June 28.	July 5.	Shares Sold.		June 28.	July 5.	Shares Sold.
Am. T. & T..	140¾	142⅛	——	Mex. Tel.....	2¾	2¾*	——
Cum. Tel.....	133½	133½*	——	Mex. Tel., pfd.	6*	6*	——
Edison E. Ill..	249	248	——	N. E. Tel....	132	133½	——
Gen. Elec....	160	161	——	W. T. & T....	10*	10½	——
Mass. E. Ry..	12	13	——	W. T. & T., p.	87*	86	——
Mass. E. R., p.	67½	69½	——				

*Last price quoted.
Shares sold are for week June 21 to June 26.

DIVIDENDS.

Bell Telephone Company of Missouri, quarterly, 2 per cent, payable July 1.

Boston Suburban Electric Company, preferred, quarterly, 75 cents per share, payable July 15.

Central & South American Telegraph Company, quarterly, 1½ per cent, payable July 9.

Central District & Printing Company, quarterly, 2 per cent, payable July 31.

Chelsea (Mass.) Gas Light Company, quarterly, 2½ per cent, payable June 30.

Consolidated Traction Company of New Jersey, semi-annual, 2 per cent, payable July 15.

Electric Light & Power Company of Abington and Rockland, semi-annual, $4 per share, payable July 1.

Indianapolis Traction & Terminal Company, 1 per cent, payable June 30.

Knoxville (Tenn.) Railway & Light Company, quarterly, preferred 1½ per cent, common 1 per cent, and extra 1 per cent, all payable June 30.

Little Rock Railway & Lighting Company, common, semi-annual, 2½ per cent, extra 1½ per cent, preferred, semi-annual, 3 per cent, all payable June 30.

Massachusetts Lighting Companies, quarterly, 1½ per cent, extra, ¼ per cent, payable July 15.

Mexican Light & Power Company, 1 per cent, payable July 15.

Mexican Telegraph Company, quarterly, 2½ per cent, payable July 15.

National Light, Heat & Power Company, quarterly, 1¼ per cent, payable July 1.

New York & New Jersey Telephone Company, quarterly, 1¾ per cent, payable July 15.

Puget Sound Electric Railway, preferred, semi-annual, 3 per cent, payable July 1.

Seattle Electric Company, common, 3 per cent, payable July 15.

United Railways Company of St. Louis, preferred, quarterly, 1¼ per cent, payable July 10.

United States Smelting & Refining Company, quarterly, preferred 1¾ per cent, common 1 per cent, both payable July 15.

Washington, Alexandria & Mt. Vernon Railway Company, 1 per cent, payable July 1.

Wheeling (W. Va.) Traction Company, 1 per cent, payable July 15.

THIRD AVENUE REORGANIZATION PLAN ANNOUNCED.—The reorganization plan formulated by the bondholders' committee representing $37,560,000 first mortgage bonds of the Third Avenue Railroad Company has been submitted to the Public Service Commission for its approval. The plan involves the purchase of the property by a new company at the foreclosure sale in September. New securities are to be issued to the old stock and bondholders, and at the same time $7,500,000 of new money is to be put into the company. It is proposed to issue immediately $16,516,800 of refunding mortgage bonds, $32,000,000 of adjustment mortgage 5 per cent cumulative bonds and $20,000,000 of stock. The old stockholders are to be assessed $25 a share. The refunding bonds are to be redeemable at $105 and accrued interest after July 1, 1914; $5,000,000 of these bonds are to be taken by an underwriting syndicate and $10,516,800 are to be issued to the holders of the present consolidated bonds, this being 8 per cent for unpaid interest and 20 per cent on account of principal; $11,445,000 shall be reserved to take up the underlying bonds, and $1,000,000 are to be used at once to provide for necessary extensions. In addition, $12,038,200 of bonds are to be reserved to make future extensions and improvements under restrictions that are to be defined in the mortgage. These are to be issued with the approval of the Public Service Commission. The adjustment bonds, which are cumulative, shall be entitled to elect the majority of the directors until the full interest, including accumulations has been received for five consecutive years. Of these bonds $30,048,000 are to be issued to the holders of the present consolidated bonds, being 80 per cent of the principal. The present stockholders are to receive upon the payment of $25 per share 125 per cent of their present holdings in the stock of the new company. It is estimated that this plan of reorganization will give the road the necessary capital to take up the receiver's certificates, and make the improvements that are deemed advisable. In submitting the plan the committee points out the fact that twice within a generation the development of street railways has necessitated the entire reconstruction of the Third Avenue Railroad, first by the installation of the cable system and, second, by electrification, and intimates that progress may possibly hereafter demand further reconstruction. The committee is composed of James N. Wallace, Adrian Iselin, Edmund D. Randolph, Mortimer L. Schiff, James Timpson and Harry Bronner.

OPPOSITION TO McCALL FERRY PLANS.—Some of the bondholders of the McCall Ferry Power Company have issued a circular through Sanderson & Porter protesting against the plan for the reorganization of the company which has been suggested by a committee composed of William M. Barnum, A. C. Bedford, S. Reading Bertron, Charles A. Coffin and Gardiner M. Lane. The plan of reorganization was detailed in our issue of June 17. The bondholders' circular claims that in order for the old bondholders to come out even under the plan it will be necessary for the new common stock to sell at par, in which event those who put up the new money would realize a profit of more than 100 per cent. The dissenters believe that it is possible to form a syndicate to take a small issue of first mortgage bonds on the property, enough to complete the work, if the old bondholders will accept par in new preferred stock with a division of the common stock between the present bondholders and the syndicate which would take the new bonds.

CALIFORNIA LIGHTING CONSOLIDATION.—Articles of incorporation have been filed at Los Angeles for the incorporation of a gas and electric company with $30,000,000 stock, which, it is claimed, is designed to control the lighting situation in Southern California. It is to be known as the Los Angeles Gas & Electric Corporation and will succeed to the property of the Los Angeles Gas & Electric Company. Walter B. Cline, president of the latter company, is the promoter of the new consolidation. At the office of N. W. Harris & Company, the fiscal agent of the Edison Electric Company in Los Angeles, it was claimed that the new corporation had nothing to do with the California properties in which the Harris firm is interested.

CHICAGO ELEVATED MERGER RENEWED.—The stockholders of the South Side Elevated Railroad of Chicago, representing a number of large holdings, are taking steps to bring about a renewal of the negotiations with the committee representing the proposed Central Terminal Company, which sought to lease the property on a guaranteed basis of yearly rentals, but failed to agree upon terms. Overtures have been made to the Illinois Trust and Savings Bank, and to the trustees of the Marshall Field estate, large holders of South Side Elevated stock, and it is hoped that through these influences a renewal of the negotiations may be brought about.

WESTERN UNION CONTROL RUMORS.—Again a rumor is abroad in financial circles that the American Telephone & Telegraph Company has secured control of the Western Union Telegraph Company. This time the story comes from Philadelphia and is given out with a considerable wealth of detail. The officials of the Western Union in this city when questioned about the matter declared that they have never heard, except in the form of rumors, of any such change of ownership. President T. N. Vail, of the American Telephone & Telegraph Company, states there is no truth in the rumor.

COPPER CONSOLIDATION IN PROSPECT.—Adolph Lewisohn was last week elected a director in the British Columbia Copper Company. It has been known for some time that Mr. Lewisohn has been acquiring a considerable interest in these mining properties. The company hopes soon to put in operation its plant, and expects to have an output of 2000 tons of ore daily. It is claimed that copper can be produced at 8 cents per pound. In this connection rumors have been circulated that a consolidation between this company and the Dominion Copper Company is not improbable.

INDEPENDENT TELEPHONES IN PENNSYLVANIA.—On July 7 application will be made at Harrisburg for a charter for the National Telephone & Telegraph Company. This charter is asked by Charles E. Wilson, general manager, and Clarence L. Harper, a director in the Keystone Telephone Company. Frank R. Shattuck, who represents independent interests in St. Louis, is also connected with the new company. It is claimed that this is one step in a plan for joining independent telephone companies into a big connected system throughout the Middle West.

AMERICAN LIGHT & TRACTION COMPANY.—The executive committee of the American Light & Traction Company has voted to recommend to the board of directors that at the July meeting the regular quarterly dividend of 1½ per cent on the preferred stock and 2 per cent on the common stock be declared, and also an extra cash dividend of 1 per cent on the common stock, and an extra 10 per cent stock dividend on the same issue. All the cash dividends will be paid on Aug. 1, while the stock dividend will probably be disbursed Sept. 1.

DETROIT EDISON ON THE STOCK EXCHANGE.—Application has been made on the New York stock exchange to list $7,979,000 of 5 per cent first mortgage bonds of the Detroit Edison Company, also $5,000,000 of capital stock already issued and $1,000,000 of stock to be issued in exchange for convertible bonds. The application states that the stock is distributed among 200 holders, and that there is no controlling interest of syndicate or otherwise.

WILMINGTON (DEL.) GAS & ELECTRICITY COMPANY.—Charles H. Dawes, of Chicago, ex-Comptroller of Currency, is at the head of a syndicate which has purchased the Wilmington Gas & Electricity Company from John and James Dobson, Philadelphia. The price paid for the property was $1,325,000. The company has a monopoly in the district it serves.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Telephone & Telegraph Company:					
May, 1909	$2,397,259	$213,176	$2,184,083	$546,667	$1,637,415
May, 1908	1,807,528	151,066	1,656,461	647,501	1,008,960
Chicago Railways Company:					
April, 1909	997,348	665,258	332,090	171,522	127,682
Copper Range Railroad Company:					
March, 1909	62,080	39,622	22,458	12,937	9,521
March, 1908	56,666	40,863	15,803	12,837	2,966
Cumberland Telephone & Telegraph Company:					
May, 1909	524,954	297,454	227,500	41,110	186,390
May, 1908	503,358	292,790	210,568	36,107	174,461
Cumberland Telephone & Telegraph Company:					
May, 1909	524,954	297,454	227,500	41,110	186,390
May, 1908	503,358	292,970	210,568	36,107	174,461
Fairmont & Clarksburg (W. Va.) Traction Company:					
April, 1909	31,296	12,643	22,251	1,892	20,358
April, 1908	29,272	10,850	20,362	1,069	19,293
Hudson & Manhattan Railroad Company:					
Quarter ended March 31, 1909	202,466	123,012	79,454	.....	.....
Lexington (Ky.) Interurban Railways Company:					
April, 1909	45,507	35,255	10,251	.....	.....
April, 1908	44,801	32,456	12,345	.....	.....
Minneapolis General Electric Company:					
April, 1909	84,450	39,901	44,548	30,098	14,450
April, 1908	76,475	34,475	42,548	30,098	10,927
Northern Ohio Traction & Light Company:					
May, 1909	188,749	103,832	84,917	43,809	41,107
May, 1908	158,409	94,878	63,531	44,154	19,377
Puget Sound Electric Railway Company:					
April, 1909	147,943	108,249	39,694	42,093	*2,399
April, 1908	132,490	84,064	48,426	38,883	9,543
Sao Paulo (Brazil) Tramway Light & Power Company:					
Year, 1908	2,287,411	783,051	1,504,360	365,468	1,138,892
Year, 1907	2,111,523	715,650	1,395,873	359,422	1,036,451
Seattle Electric Company:					
April, 1909	422,128	261,842	160,285	92,629	67,656
April, 1908	356,089	212,484	143,604	77,380	66,223
Toledo Railways & Light Company:					
May, 1909	212,835	126,611	86,224	70,871	15,673
May, 1908	198,978	109,444	89,529	71,719	17,891
United Railways Company of St. Louis:					
May, 1909	975,544	597,240	378,304	232,792	145,512
May, 1908	920,765	591,543	329,222	232,278	96,944

*Deficit.

GENERAL NEWS

Construction News.

CAMP HILL, ALA.—Edgar B. Kay, of the engineering department of the University of Alabama, University, Ala., has been engaged to prepare plans for the proposed municipal electric light plant, for which $10,000 in bonds was recently voted. Power for the plant will be secured from a hydro-electric plant on Sandy Creek or from Dadeville, Ala.

UNIONTOWN, ALA.—Edgar B. Kay, of University of Alabama, University, Ala., has been engaged to prepare plans for rebuilding the electric light and water station.

BENSON, ARIZ.—Plans are being considered by the Benson Water Company for extending its water service and also for the installation of an electric light plant in the near future.

PHOENIX, ARIZ.—A compromise has been entered into between the Pacific Gas & Electric Company and the parties interested in the proposed new company whereby the franchise for a competing gas and electric company will not be asked for at least six months after Aug. 1. The Pacific Gas & Electric Company has announced a reduction in its schedule of rates to take effect from Aug. 1, under which all consumers will receive a substantial reduction. Under the new schedule, the minimum charge will be $1, instead of $1.50, the present minimum rate for both electric and gas service. The maximum rate for electricity is 15 cents per kw-hour, with 10 per cent discount on all bills paid by the tenth of the month. For commercial lighting a net rate of 10 cents per kw-hour is made. The charge for gas is $2 per 1000 cu. ft., with a discount of 10 per cent for prompt payment.

MANSFIELD, ARK.—The City Council has granted the Boothe Telephone Company permission to erect and operate a telephone system in Mansfield.

BEAUMONT, CAL.—A pipe line is being constructed in connection with the system which will connect the Beaumont Land & Water Company's shaft with the lower pumping shaft and enable the company to generate electrical power to the amount of 260 hp. The plant will furnish electricity to operate the lower and upper pumping plants, and also for lighting La Mesa Mira Valley, and for lamps and motors in Beaumont.

BERKELEY, CAL.—The Southern Pacific Railroad Company has decided to equip its railway on Shattuck Avenue to be operated by electricity instead of steam power. The board of trustees has granted the company permission to make the change.

GLENDALE, CAL.—The citizens on June 22 voted to issue $60,000 in bonds, the proceeds to be used for the construction of a new municipal electric light plant.

MONTEREY, CAL.—We are informed that the Monterey & Del Monte Railway Company, which proposes to construct an electric railway to connect Monterey and Seaside, five miles in length, will commence work on the proposed railway about July 15. The company will do its own construction work with the exception of the bridge, 200 ft. long, across Lake Del Ray. Materials for the road are now being purchased. The company is capitalized at $100,000. H. R. O'Bryan, of Monterey, is president.

OROVILLE, CAL.—It is reported that the Messilla Valley Gold Gravel Mining Company has decided to remodel its prospecting tunnel into a full-size timbered one. Plans are being prepared for electrical equipment. J. W. Coffin is president of the company.

ROSEVILLE, CAL.—Extensive improvements are being made at the California Granite Works, which will include the installation of electric travelers and other apparatus.

SAN BENITO, CAL.—The Town Board of San Juan has accepted the bid of the San Benito Light & Power Company for a franchise through the town. The amount paid for the franchise was $50.

SAN FRANCISCO, CAL.—At a special election held June 24 the citizens voted against the municipal street railway proposition. It was proposed to issue bonds to the amount of $1,950,000 for the reconstruction of the Geary Street railway, the plan being to replace the old cable system by an underground electric conduit system.

SAN FRANCISCO, CAL.—It is reported that the United Railroads Company has agreed to construct a railway on Cortland Avenue and through the Bernal Heights District from Mission to Folsom streets as soon as the subscriptions amounting to $5,000 have been deposited in a bank. The new line will be about one mile in length and will cost about $28,000.

SAN FRANCISCO, CAL.—It is reported that the San Francisco Gas & Electric Company and the Spring Valley Water Company will ask the United States circuit court for an injunction restraining the Supervisors from enforcing the rates adopted for the coming fiscal year, which will become operative July 1. It is said that the telephone company will not oppose the reduction in rates ordered by the city authorities.

SANTA ANA, CAL.—The franchise applied for by the Santa Ana Valley Irrigation Company for the erection of transmission lines through the Santa Ana Canyon has been ordered to be sold July 15 to the highest bidder.

DENVER, COL.—It is reported that the Denver Gas & Electric Company will rebuild the generating plant, recently damaged by an explosion. Frank W. Frueauff is vice-president and general manager.

MIDDLETOWN, CONN.—The Middletown Electric Light Company is installing a new 250-hp boiler in its plant on Court Street.

STONINGTON, CONN.—At a special meeting held June 14 the citizens voted to authorize the warden and burgesses to enter into a contract with the Mystic Power Company for street lighting for a term of ten years at the rate of $15 per lamp per year, which is the same price paid under the present contract.

WATERBURY, CONN.—It is reported that the Connecticut Company has appropriated $500,000 for the construction of a large power plant in Waterbury, which will be located near the present substation. It is said that the plant will supply electrical energy for the New Haven, Waterbury and Bridgeport lines. David B. Neth is superintendent of the local electrical department.

WASHINGTON, D. C.—The superintendent of U. S. Capitol building and grounds will soon call for bids to be opened July 10 for installing an electric clock system in the U. S. Senate office building, which will consist of one master clock and 275 secondary clocks.

WASHINGTON, D. C.—Bids will be received until July 13 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following supplies: Mare Island, Cal., Schedule 1363—1250 dry battery cells. Mare Island, Cal., or Brooklyn, N. Y., Schedule 1364—39 watertight annunciators, 6000 carbons for arc lamps, 3750 searchlight carbons, 350 lb. magnet wire, 25,000 ft. silicon bronze wire, 25,000 ft. single conductor wire, micanite plate, etc. Schedule 1365—4500 lb. seamless drawn copper wire. Washington, D. C., Schedule 1373—remodeling 110-ton electric traveling crane.

WASHINGTON, D. C.—Bids will be received until July 6 at the Bureau of Supplies and Accounts, Washington, D. C., for furnishing the following supplies: Mare Island, Cal., Schedule 2—Combination ferrules, cast-iron tees and elbows; automatic continuous draining steam traps, etc.; standard brass globe valves and brass nickel-plated, rough body valves; one 144-gal. electric weld coil boiler and a storage tank. Brooklyn, N. Y., Schedule 3—Double-braided, rubber-covered wire, four propeller fans. Schedule 4—Asbestos magnesia pipe covering, etc. Schedule 4—1500 ft. magnesia sectional pipe covering; 12,200 lb. metal lath and galvanized staples. Annapolis, Md.—Schedule 1372—Four water-tube boilers.

JACKSONVILLE, FLA.—Plans are being considered for extending the municipal street lighting system by the installation of 100 or more magnetite arc lamps. R. N. Ellis is superintendent.

QUINCY, FLA.—Plans are being made for extensions to the municipal electric light plant, which will involve an expenditure of about $9,000.

ATLANTA, GA.—The Piedmont Power Company has applied to the County Commissioners for a franchise to erect its high-tension transmission lines along the county roads which lead into Atlanta. The company proposes to supply electricity from its plant at Tallequah Falls in Atlanta. Louis B. Magid is president of the company.

ATLANTA, GA.—The North Georgia Power Company has filed a petition with the City Council asking for an extension of 12 months of its franchise to operate in Atlanta. Steel towers have been built up to the city limits from Gainesville and the company is supplying several large suburban manufacturing plants near this city. It is said that the company would have been in Atlanta before but for the stringent times of the fall and winter of 1907-1908.

CEDARTOWN, GA.—Beginning with July 1, the municipal electric light plant will establish a day service, which will be maintained until fall, at least. W. T. Hardy is superintendent.

COLUMBUS, GA.—The Columbus Railroad Company has contracted with the Stone & Webster Engineering Corporation for the reconstruction of the City Mills plant to increase the output of the station to 600 kw, 2300-volt, alternating-current and 200 kw, direct current for railway service. The work will include the installation of a new two-phase generator with auxiliaries and replacing two water wheels.

HAWKINSVILLE, GA.—It is reported that J. B. McCrary & Company, of Atlanta, Ga., have been engaged to prepare plans for the proposed municipal electric light plant. It is stated that contracts for construction of plant will be awarded soon.

SAVANNAH, GA.—The Savannah Electric Company has entered into a contract with the Stone & Webster Engineering Corporation, of Boston, Mass., for the installation of a new 1000-kw turbine and auxiliaries in the Indian Street Station.

WAYCROSS, GA.—At an election held June 19 the citizens voted against the proposition to issue $36,000 in bonds to establish a municipal electric light plant. The purchase of the plant of the Waycross Electric Light & Power Company has been under consideration.

GARDEN VALLEY, IDAHO.—The Wharton dam on the Payette River, located near Garden Valley, is completed. The dam is owned by the Boston & Idaho Dredging Company, and will be utilized to generate electricity for the placer and quartz mines in the basin, and will also furnish electrical power to operate several dredges owned by the company. The water wheels have been installed and the dynamos are ready to be placed. The plant will have an output of 2000 hp. A. T. Ingalls is engineer.

POST FALLS, IDAHO.—The Washington Water Power Company, of Spokane, Wash., has purchased all the property of the Cable Milling Company in Post Falls, consisting of a large flouring mill, grain elevators, water power, railroad spurs, and several acres of land adjoining the falls on the bank of the Spokane River. The Washington Water Power Company will enlarge the mill and operate it by electricity. An electric plant has already been installed in the mill to furnish electricity.

HIGHWOOD, ILL.—The Chicago & Milwaukee Electric Railroad Company has recently placed contracts with the General Electric Company, of Schenectady, N. Y., for one 1500-kw, 25-cycle, 600-volt rotary converter, three air-blast 13,200-volt to 430-volt 185-kw transformers, together with the necessary reactive coils, oil switches and switchboard panels.

KANKAKEE, ILL.—The Foley-Williams Manufacturing Company is equipping its factory for electric motor drive. The equipment will include 140 motors, varying from one-quarter to 30 hp. It is said that a saving of 50 per cent will be made in the cost under the new service, the old costing about $6,000 yearly.

KANKAKEE, ILL.—Arrangements are being made by the Kankakee Electric Light Company for the construction of an electric plant with an output of 300 hp at its dam in this city. The new plant will be operated in conjunction with its present plant, which now develops 1000 hp. Steam power will be used as an auxiliary to the water power plant. The company recently closed a large contract with the Foley-Williams Manufacturing Company to furnish electricity for operating its plant.

PEORIA, ILL.—The Peoria Railway Terminal Company has been granted a 40-year franchise by the City Council to construct a street railway on Washington Street.

PETERSBURG, ILL.—The City Council has granted the Springfield, Beardstown & Quincy Interurban Railway Company a 50-year franchise in Petersburg.

QUINCY, ILL.—We are informed that the Illinois Soldiers' and Sailors' Home, of Quincy, is in the market for equipment for a complete electric lighting plant.

SPRING VALLEY, ILL.—Plans are being considered by the Spring Valley Electric Light Company for rebuilding its entire system and establishing a day service. Charles Robinson is manager.

BATESVILLE, IND.—The American Furniture Company, owner of the local electric plant, is contemplating establishing an electric storage garage in connection with its electric plant. A. W. Romweber is secretary and manager.

BRAZIL, IND.—The Knight-Brinkerhoff Piano Company is asking for bids for the construction of three buildings for a steam and electric power plant which the company proposes to install. It is said that plans and specifications will be ready for engines, boilers and generators about July 1. H. B. McMillan is architect.

CRAWFORDSVILLE, IND.—The Home Telephone Company has been reorganized and is now controlled by local citizens. The officers are: Theodore H. Restine, president; D. M. Peek, vice-president; Chas. W. Hymer, secretary, and J. K. Johnson, treasurer. The company is erecting a new exchange and office building and is preparing to install the automatic telephone system throughout the city.

DANVILLE, IND.—E. D. Crawley is erecting a factory building to be equipped with modern machinery for the manufacture of lightning arresters under the Hiatt patent. The device is for use on telephone wires. The plant will be operated by electricity.

EVANSVILLE, IND.—The contract for the lighting of the City of Evansville with gas for the next five years has been awarded to the Evansville Gas & Electric Light Company. A material reduction has been made for electric arc lamps.

HAGERSTOWN, IND.—The City Council has granted a franchise to Messrs. Hancock and McMillan for the construction and operation of a combined water works and electric light plant.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company has paid the city $8,877.27, its annual dues under the company's franchise, which calls for the payment to the city of 5 per cent of its gross earnings.

INDIANAPOLIS, IND.—The Indianapolis Telephone Company has commenced work on improvements to its system, as required by the amended franchise recently granted by the city, which will involve an expenditure of $500,000. The work of rebuilding the entire district north of Fall Creek by changing overhead construction to underground and installing additional cable is under way. The company will next install a new switchboard in the north exchange building, increasing the capacity 1500, and construct and equip a new building on Bevelle Avenue in order to enlarge the eastern division of its system. These improvements will be followed by the completion of the central exchange building, in which new equipment will be installed.

LAFAYETTE, IND.—Bids will be received by A. C. McCorkle, chairman Board of Trustees State Soldiers' Home, until July 10 for the installation of an electric motor for laundry, etc.

VALPARAISO, IND.—The capital stock of the Valparaiso & Northern Railway Company has been increased to $250,000. The company is planning to construct an interurban railway to connect Valparaiso, Chesterton and Gary. Lewis E. Woodward is secretary.

ZIONSVILLE, IND.—The Zionsville Water & Electric Light Company has recently replaced its 32-cp incandescent lamps with 40-cp tungsten lamps for street lighting. The company is contemplating installing a new high-speed automatic engine to replace the present engine, and equipping its boilers with improved grates and furnaces. As the street lamps are connected to the commercial lighting circuit it is proposed to install Johnston & Johnston cut-offs for independent control of the street lamps. W. H. Palmer is secretary and manager.

BEDFORD, IA.—The citizens have voted to grant a lighting franchise in Bedford to Mr. Burt.

DES MOINES, IA.—Contracts have been awarded by the Des Moines Electric Company in connection with its new power plant as follows: For construction of power house, to W. H. Brereton, for $67,000; the Des Moines Bridge & Iron Company, for structural steel, and the Turner Improvement Company, for placing wires underground, for $80,000.

SEYMOUR, IA.—The question of rebuilding the municipal electric plant this year is under consideration. F. Kellogg is superintendent.

WEBSTER CITY, IA.—It is reported that the Fort Dodge, Des Moines & Southern Interurban Railway will equip the creek road to be operated by electricity and extend its lines through Blairsburg, Dows and Clarion.

CHAPMAN, KAN.—The Dickinson County Light & Power Company is contemplating the installation of a 50-hp gasoline engine this fall. M. P. Sanborn is manager.

LINDSBORG, KAN.—Plans are being considered for the installation of a new 100-hp engine, a 150-kw alternating-current, 3-phase generator, in the municipal electric light plant. M. H. Blaine is superintendent.

NICKERSON, KAN.—The Town Council is considering the question of installing a municipal electric light plant and water-works system.

WICHITA, KAN.—We are informed that the Wichita Railroad & Light Company is planning to construct about four miles of track. W. R. Morrison is superintendent.

CYNTHIANA, KY.—Bids will be received by W. M. Moore, chairman finance committee, until Aug. 2 for lighting the streets, alleys and other public places for a term of six or ten years beginning April 1, 1910, with 40 or more arc lamps; bids will also be received at the same time for an incandescent-lamp system requiring 90 or more 40-cp lamps under specifications now on file in the office of the city clerk. For further information address W. W. Van Deren.

MADISONVILLE, KY.—Plans are being considered by the managers of the municipal electric light plant for extensions and improvements to the plant, including the installation of a 200-kw generator, an engine and 150-hp boiler. E. B. Robards is manager.

NICHOLASVILLE, KY.—The contract for grading the Nicholasville interurban railway has been awarded to J. W. Oliver, of Knoxville, Tenn., for approximately $150,000. The proposed railway will connect Knoxville and Nicholasville.

VALLEY VIEW, KY.—Plans are being made by the Lexington Interurban & Railways Company for the construction of its proposed power plant at Valley View, work on which will soon commence. Electricity generated at the plant will be transmitted to Lexington, Ky., where it will be utilized for the interurban railways and commercial lighting. The cost of the plant is estimated at $250,000. I. L. Oppenheimer is general manager; J. G. White & Company, of New York, N. Y., are engineers and contractors.

UNION BRIDGE, MD.—It is reported that E. A. Buckey is interested in a proposed electric light plant, work on which has already commenced.

LOWELL, MASS.—Mayor George H. Brown has recommended to the City Council a proposition to improve the street lighting system of the main thoroughfares of the city. It is proposed to replace the present arc lamps with cluster lamps, which would involve an expenditure of $25,000 and would cost $6,500 additional a year to maintain, the cost of the installation to be borne by the Lowell Electric Light Corporation, which it is said the company is willing to assume. The plans call for replacing the present arc lamps, for which the city pays $100 each per year, with four cluster lamps at $22.50 each per year, making the cost for each cluster $90 per year.

WORCESTER, MASS.—The Connecticut River Power & Transmission Company has applied to the Board of Aldermen for permission to enter the city for the purpose of furnishing electricity for lamps and motors in Worcester. The company has already a contract with the American Steel & Wire Company to furnish electricity for the Grove Street plant.

ALBANY, MINN.—Bids will be received by the Village Council for the sale of bonds to the amount of $7,000, the proceeds to be used for establishing a lighting system for streets, public buildings and for commercial and private use.

HIBBING, MINN.—The Village Board has granted the petition of the citizens living in the Penobscot district asking for lamps along the road from the village a distance of about half a mile.

MILAN, MINN.—The construction of a telephone line to Appleton is under consideration by the Milan Mutual Telephone Company.

MINNEAPOLIS, MINN.—At a meeting of the City Council held June 11, the Minneapolis General Electric Company announced a reduction in its rates for electricity to all consumers, to become effective July 1. The reduction for residential lighting will amount to about 17 per cent, and from 10 to 17 per cent on commercial lighting, according to the amount consumed. The reduction for electricity for motors varies from 9 to 20 per cent.

NORTHFIELD, MINN.—The Northfield Telephone Company has applied for a franchise in Northfield. The question will be submitted to a vote July 13.

PRINCETON, MINN.—The City Council is reported to have decided to install a storage battery in the municipal electric light plant. The cost is estimated at $3,000.

ROCHESTER, MINN.—The citizens are considering the question of calling an election to vote on the proposition to issue bonds for the construction of an electric light plant.

BRANDON, MISS.—W. F. Owen is reported to be interested in a proposed electric light plant which will have sufficient output to supply 300 lamps.

JACKSON, MISS.—The City Council has adopted an ordinance under which the lighting committee of the Council is directed to enter into a 10-year contract with the Jackson Light & Railway Company on a basis of $87.50 per lamp per year under an all-night schedule, which is $26.40 less than the price under the present contract. The city now pays $114 for each arc lamp. It is expected that the company will refuse to accept the terms of the ordinance. Through error this item was published in the issue of June 24 under Jackson, Fla.

SILVER CREEK, MISS.—The Council is considering the question of granting a franchise for an electric light plant.

MONETT, MO.—An election will soon be held to vote on the proposition to issue $35,000 in bonds for the construction of a municipal electric light plant. The city has been without street lamps for over a year, owing to failure to come to an agreement with the local electric light company.

SPRINGFIELD, MO.—The City Council has passed the measure providing for an extension of the franchise of the Springfield Electric & Gas Company. It is said that Mayor Ernst will sign the ordinance, when it will be submitted to a vote of the people at a special election to be called by the Mayor.

GORDON, NEB.—Work will soon commence on the construction of a central telephone exchange in Gordon.

GOLDFIELD, NEV.—All the mines and mills of Goldfield, Tonapah and Rhyolite, and those in other parts of Southern Nevada dependent upon the Bishop power plant, have been obliged to close down, owing to the dam having been destroyed by floods.

ORANGE, N. J.—The street committee of the Common Council has decided to recommend to the City Council the appointment of Runyon & Carey, of Newark, N. J., consulting engineers, to have charge of the construction of the municipal electric light plant. The engineers agree to prepare plans and specifications for the proposed plant and to supervise the work, and have also agreed to take charge of the lighting system for the first year without extra compensation.

BROOKLYN, N. Y.—Bids will be received until July 6 by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., for installing electric light wiring and fixtures, etc., in classrooms Nos. 3, 7, 10, 14, 18, 29, 33 and 44, and fire signal system in Public School 16, on Wilson Street, Borough of Brooklyn.

BUFFALO, N. Y.—Work has commenced on the installation of the new electric plant and equipment for the city hall. It is expected to have the plant completed and in operation by Nov. 1.

BUFFALO, N. Y.—The report of the Finance Committee of the Common Council, recommending that a contract be made for placing the overhead wires of the Police and Fire department underground, has been adopted by the Board of Aldermen.

BUFFALO, N. Y.—Bids will be received by the Department of Public Works, City Hall, Buffalo, until July 6 for a 100-kw, 125-volt turbo-generator set. Plans and specifications can be seen and forms of proposals can be secured on application to the Bureau of Water. Francis G. Ward is commissioner.

FORT TOTTEN, N. Y.—The contract for installing an electric lighting system at Fort Totten, N. Y., was awarded to Coburn & Cooke, of Newport News, Va., for $15,374.

FRANKLINVILLE, N. Y.—The Empire Electric Company is making extensive additions and improvements to its plant, which include the installation of a 375-kw alternator, a 500-hp engine, and 200-hp boiler with Roney stokers. G. W. G. Ferris is treasurer and manager.

FULTON, N. Y.—Announcement has been made that the Fulton Light, Heat & Power Company has changed its plans in regard to the construction of an auxiliary steam plant. It is said that the building will be twice the size originally planned and the equipment will be increased in proportion. L. W. Emerick is vice-president and manager.

HILTON, N. Y.—The Board of Trustees has granted John E. Cooper a franchise for the erection of transmission lines for the distribution of electricity for lamps and motors in Hilton.

HORNELL, N. Y.—The Common Council has renewed the contract for street lighting with the Hornell Electric Company for a period of five years from June 1. Under the terms of the new contract the company is to furnish arc lamps at $78 per lamp per year and $14 each per year for incandescent lamps, which is quite a reduction on the previous contract.

MT. VERNON, N. Y.—The Public Service Commission has granted the Westchester Lighting Company permission to purchase the entire $804,000 capital stock of the Northern Westchester Lighting Company and all the $500,000 common stock of the Peekskill Lighting & Railroad Company, of Peekskill, N. Y., for $505,000, and $75,000 of its 6 per cent cumulative preferred stock at $75,000; also $90,000 of the first consolidated mortgage bonds of the Northern Westchester Lighting Company at $81,000. The Westchester Lighting Company is authorized to issue $580,000 5 per cent first collateral trust bonds, the proceeds to be used for acquiring stocks authorized to be transferred to it by the Northern Westchester Lighting Company and the Peekskill Lighting & Railroad Company.

NEW YORK, N. Y.—Plans for the new substation of the New York Edison Company to be erected at 49 West Twenty-sixth Street have been completed. The building will be 50x100 ft. and will cost about $150,000.

NEW YORK, N. Y.—Bids will be received by John W. Brannan, president of the Board of Trustees of Bellevue and Allied Hospitals, Twenty-sixth Street and First Avenue, New York, N. Y., until July 7, for electric lamps. Blank forms may be obtained at the office of the contract clerk, at 419 East Twenty-sixth Street, New York, N. Y., where bids and deposits are to be delivered.

NEW YORK, N. Y.—The contract for installing electric equipment in new Public School 101, Borough of Manhattan, has been awarded to E. J. Duggan, New York, N. Y., for $9,463. Contract for installing electric equipment in addition to and alteration in Public School 30, Borough of Bronx, was awarded to the New York Construction Company for $4,956. C. B. J. Snyder is superintendent of school buildings.

ONEIDA, N. Y.—The Public Service Commission, Second District, has granted the Oneida Railway Company a certificate of necessity for the construction of its proposed extension from Sherill to Kenwood, a distance of one and one-half miles, which will involve an expenditure of about $68,000.

UTICA, N. Y.—The Home Telephone Company has awarded the contract for the construction of a subway on three streets in this city to N. D. Peters & Company, of Utica.

UTICA, N. Y.—The Utica Southern Railroad Company has filed an amendment to its charter with the Secretary of State as to the location of its proposed railway. Under the present plan it is proposed to build from Clinton to Hamilton, with the Deansboro-Waterville branch, and thence to Hamilton to Norwich, which will add 27 miles to the original length of the railway. The company will apply to the Public Service Commission, Second District, for permission to build the extension.

WAVERLY, N. Y.—The Elmira, Corning & Waverly Railroad Company has been granted permission by the State Highway Commission to construct its proposed electric railway from Elmira to Wellsburg on the State highway.

RALEIGH, N. C.—Formal announcement has been made of the sale in equity of the property and holdings of the Rockingham Power Company to take place in Wadesboro, N. C., on July 12 at which there will be offered for sale all of the property of the company. The property embraces extensive water rights, water powers, etc., along the Pee Dee River, in North Carolina, together with properties, etc., conveyed by Hugh MacRae & Company, of Wilmington, to the Rockingham Contracting Company, also all rights, titles, easements, etc., secured for the Rockingham Power Company by the said Hugh MacRae Company and dams, power house, material structures, telephone lines, etc., and electrical machinery and appliances, plans, specifications, correspondence and all personal property belonging to the Rockingham Power Comany, also 250 miles of rights of way, etc., the purchaser to put up $25,000 cash or to furnish $100,000 bonds issued to the Knickerbocker Trust Company, the remainder of the purchase price to be paid in bonds issued under the aforesaid mortgage. This property and plant has been the subject of much tangled litigation. The property is well located and a large sum has already been expended in this electrical development. William H. Browne and W. A. Leland are receivers of the Rockingham Power Company.

WINSTON-SALEM, N. C.—The Southern Power Company is erecting a substation in this town for the distribution of electrical energy.

BANTRY, N. D.—The Bantry Telephone Company, it is said, will erect at least 10 miles of telephone line this summer.

BEACH, N. D.—Application has been made to the Village Council for a franchise to construct and operate electric light and water works plant.

MINOT, N. D.—The capital stock of the Minot Light & Telephone Company has been increased from $100,000 to $200,000.

STREETER, N. D.—The Central Telephone Company is planning to install between 30 and 40 miles of new telephone line.

ALLIANCE, OHIO.—Arrangements are being made by the Stark Electric Railroad Company for the installation in its power house of one 100-kw Westinghouse turbine, with condenser and other accessories, orders for which have already been placed. Knox Engineering Company, Fisher Building, Chicago, Ill., are engineers.

CLEVELAND, OHIO.—The directors of the Cleveland, Barberton, Coshocton & Zanesville Railway Company have authorized an issue of $6,000,000 in bonds, the proceeds to be used for the construction of an electric railway from Cleveland to Zanesville. J. J. Breitinger is president.

COLUMBUS, OHIO.—The City Council on June 21 passed the electric light rate ordinance over Acting Mayor Rightmire's veto. The ordinance makes the rate seven cents per kw-hour, the same as the present rate.

CUYAHOGA FALLS, OHIO.—Bids will be received at the office of C. D. Crumb, Village Clerk, until July 10 for the purchase of $4,000 in bonds, the proceeds to be used for improvements to the municipal electric light system.

DAYTON, OHIO.—Plans are being considered by the Dayton & Troy Electric Railway Company for an extension of its railway in the southern part of Piqua County, at a cost of about $25,000. C. M. Paxton is general manager.

LIMA, OHIO.—F. D. Carpenter, general manager of the Western Ohio Railway Company, writes that the company has purchased a 1000-kw Westinghouse low-pressure turbine.

MT. HEALTHY, OHIO.—The Council has granted the Mt. Healthy Power & Light Company a 25-year franchise to furnish electricity and gas in Mt. Healthy. Paul Hooven and B. Seevers, of Hamilton, Ohio, are promoters of the project.

NORWOOD, OHIO.—The Southwestern Ohio Traction Company has applied to the City Council for a franchise to operate a street railway on various streets in Norwood.

WEST LIBERTY, OHIO.—It is reported that the local electric light plant owned by R. M. Kelley has been purchased by Arthur Hartzler for $10,000. It is said that improvements will be made to the plant and service.

YOUNGSTOWN, OHIO.—Plans are being considered by the Youngstown Park & Falls Street Railway Company for improvements to its system, which will include some double tracking.

BARTLESVILLE, OKLA.—The Bartlesville Light & Water Company, recently incorporated, proposes to operate an electric light plant with an output of 1700 hp. The company is capitalized at $200,000 and the officers are: S. J. Smallwood, president; L. W. Rowland, vice-president; R. L. Beatie, treasurer, and V. McFadden, secretary.

DURANT, OKLA.—An election will soon be held to vote on the proposition to issue $20,000 in bonds for the installation of an electric light plant.

LONE WOLF, OKLA.—The city is reported to have awarded the contract for construction of an electric light and water works system for $42,000.

McCURTAIN, OKLA.—The City Electric Light & Power Company, it is reported, is planning to install a plant to cost $8,000. O. C. Gleim, of McCurtain, is engineer, and A. R. Brauham is secretary.

McMINNVILLE, ORE.—At an election held recently the citizens voted to issue $30,000 in bonds, the proceeds to be used to complete the municipal electric light plant and to improve the water works system.

PORTLAND, ORE.—The sub-station of the Portland Railway, Light & Power Company, on Seventh Street, was badly damaged by fire June 14. The damage to the machinery is estimated at about $100,000.

ST. HELENS, ORE.—The McCormick Lumber Company has been granted a franchise by the Council to install and operate an electric plant in St. Helens.

SALEM, ORE.—The contract for rewiring the State Capitol was awarded to the Pacific Electric Engineering Company for $5,212.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until July 6 for furnishing electrical material, including fixtures, fittings, cable, wire, line material, rail attachments, track drills, hardware, crossarms, solder tape, etc. Blanks and information pertaining to this circular (No. 520-A) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., and 316 Hibernia Bank Building, New Orleans, La.; also from the U. S. Engineer offices in Pittsburgh, Pa.; Chicago, Ill., and St. Louis, Mo. Captain F. C. Boggs is general purchasing officer.

ALLENTOWN, PA.—It is reported that the directors of the Lehigh Valley Transit Company have authorized President R. P. Stevens to construct the new railway requested by the City Council and to order new equipment for the proposed belt line, work on which has just commenced. It is said that plans are being made to improve the electric railway service, which will involve an expenditure of about $1,000,000.

HANOVER, PA.—The Hanover Light, Heat & Power Company has placed a contract with the General Electric Company, Schenectady, N. Y., for one 300-kw motor-generator set, with switchboard panels, arranged to feed the railway service and reversed for supplying 2200 volts for lighting service. Robert E. Manley is manager.

MEDIA, PA.—The stockholders of the Media Electric Light Company, of Media; the Citizens' Electric Light & Power Company, of Clifton Heights; the Farraday Light Company, of Morton, and the Philadelphia Suburban Electric Light Company, of Lansdowne, on June 21 voted to consolidate the companies under the name of the Delaware County Electric Company, which now practically owns all the electric light companies in Delaware County. It is understood that the present plans contemplate the construction of a large central power plant. The plants will be operated under one management. The following officers were elected: W. Roger Fronefield, of Media, president; William F. Morris, of Penn Yan, vice-president; Joseph W. Taylor, of New York, N. Y., secretary and treasurer, and J. W. Barstow, of New York, N. Y., general superintendent and engineer.

PHILADELPHIA, PA.—At a meeting of the board of directors of the Philadelphia Rapid Transit Company held June 21 extensions and improvements to the power station of the company at Thirty-third Street and Market Street were decided upon, which will involve an expenditure of about $225,000. The purchase of a 600-kw Westinghouse exhaust steam turbine was authorized for the above-named station, and $100,000 was appropriated for the foundation for an extension of the power house on North Delaware Avenue.

PHILADELPHIA, PA.—The Keystone Telephone interests are taking a leading part in the Pennsylvania arrangements for carrying into effect the project of joining independent telephone companies into one system, which will be able to give long-distance service, as well as local service, to compete with the Bell system. On July 7 application will be made at Harrisburg for a charter for the National Telephone & Telegraph Company by Charles E. Wilson, general manager, and Clarence L. Harper, a director of the Keystone Company, and Frank Shattuck, who represents them and important St. Louis interests. The new company proposes to construct and operate a long-distance telephone line at a cost of $1,000,000, from Philadelphia to the Ohio line, via Pittsburgh. Another company by the same name will carry the telephone line across Ohio. Similar companies will be organized in New York, Indiana and other states to provide a long-distance telephone system connecting local systems between Philadelphia and St. Louis.

SLATINGTON, PA.—The contract for lighting the streets of Slatington has been awarded to the Lehigh Valley Transit Company, of Allentown, Pa., for a period of five years. The company is to furnish arc lamps at $77 each per year, and 32-cp. tungsten lamps at $17 per lamp per year, with an all-night service.

TOWANDA, PA.—It is reported that Melkelham & Dinsmore, of New York, N. Y., are interested in a project to build a dam across the Susquehanna River at Towanda. The cost of the dam is estimated at $1,000,000, and electricity will be generated for distribution in this section of the state. About 15,000 hp will be developed.

WOONSOCKET, R. I.—The Blackstone Valley Gas & Electric Company has commenced work on the construction of a 13,000-volt transmission line, with a carrying capacity of 1000 kw, from the South Station in Pawtucket to Station No. 1, Woonsocket, together with new transformer stations at each end. The Stone & Webster Engineering Corporation, of Boston, Mass., has charge of the construction work.

ROCK HILL, S. C.—Arrangements have been completed for improving the local telephone system. R. M. Lewis, of Atlanta, Ga., will have charge of the work, which will include the installation of switchboard and the common battery system.

BINGHAMTON, TENN.—Plans are being made by the Binghamton Light & Power Company to double the boiler and generator capacity of its plant by September, 1909. W. M. Tucker is manager.

CHATTANOOGA, TENN.—The hydro-electric plant at the lock and dam at Hale's Bar, 17 miles distant from the city, has been placed in operation and is now ready to furnish electricity for manufacturing purposes in Chattanooga. The lock, dam, power house and transmission line cost over $3,000,000. The power plant has an output of 50,000 hp.

NASHVILLE, TENN.—The Nashville Railway & Light Company has filed amendments to its charter, giving the company the right to make several extensions to its system, which will enable it to construct several lines to connect Nashville with many interesting and historic points in the county.

NASHVILLE, TENN.—The Nashville Interurban Railway Company has increased its capital stock from $400,000 to $600,000. The company proposes to build an electric railway from Franklin to Mt. Pleasant, a distance of 40 miles. It is understood that work will commence on the proposed extension this year.

CROSBYTON, TEX.—It is reported that Chicago capitalists are interested in the construction of a proposed hydro-electric power plant at Silver Falls, on White River, four miles from Crosbyton. For further information address F. E. White, secretary of Crosbyton Commercial Club.

FORT WORTH, TEX.—The Northern Texas Traction Company is considering the question of constructing an electric railway to Riverside.

SAN MARCOS, TEX.—The City Council has adopted a resolution agreeing to extend the franchise of the San Marcos Electric Company, its franchise having recently expired. The proposition provides for a maximum rate for electricity for lamps in the city, and for a more extensive system of street lighting than is now provided. The company recently passed into the control of bondholders at a foreclosure sale, and it is not yet known whether the proposition will be accepted or not.

SINTON, TEX.—J. M. Greer, of Livingston, Tex., is reported to be interested in a project to establish an electric light plant in connection

with a 10-ton ice plant. A company has been organized with a capital stock of $10,000 to operate the plant.

HYRUM, UTAH.—The City Council has decided to remodel the municipal electric light plant so as to increase the service. It is also proposed to extend the transmission line to the town of Wellsville to furnish electricity for lamps.

BASIC CITY, VA.—W. M. Page, city treasurer, writes that the contract for the construction of the municipal hydro-electric plant has been awarded to the Morrison Machinery & Supply Company, of Richmond, Va., for $20,000.

BROOKNEAL, VA.—The Staunton River Power Company, which proposes to develop water power at Brookneal and McIvor's Falls, on Staunton River, is reported as having made arrangements with New York capitalists for financing the proposed hydro-electric plant. It is estimated that from 8000 to 10,000 hp can be developed for transmission by electricity. E. R. Monroe and associates are interested in the projects.

FORT HUNT, VA.—Contracts for the equipment for the pumping station at Fort Hunt, Va., have been awarded as follows: To the G. & W. Manufacturing Company, of New York, N. Y., for power plant machinery, which includes boilers, generators, pumps and compressors, for $9,700; the John W. Danforth Company, of Buffalo, N. Y., for construction of pumping station, including plumbing, electric wiring and fixtures, and repairing and installing two generator sets, for $11,250, and construction of reinforced-concrete reservoir, to Lyons Brothers, of Tippett, Md., for $4,500. Captain H. L. Pettus is constructing quartermaster.

RICHMOND, VA.—The ordinance committee of the City Council has instructed the city attorney to prepare an ordinance to require the Southern Bell Telephone Company to improve its local system or surrender its charter.

BELLINGHAM, WASH.—O. E. Booby and H. W. Swain have made application to the County Commissioners for a franchise to operate an electric light system in Nooksack and Everson.

HUSUM, WASH.—The Husum Light & Power Company has completed its transmission line into White Salmon, and will soon be prepared to furnish electricity for lamps and motors in that town. It is said that several large ranch owners in this vicinity will take advantage of the service for power purposes. The residents of Trout Lake and vicinity are negotiating with the company to supply electricity for lamps and motors. Trout Lake is about 18 miles distant.

METHOW, WASH.—Plans are being made to develop the water power of the Methow River in Okanogan County for the purpose of furnishing electricity for lamps and motors in the small towns in the county and for operating the pumps for irrigating thousands of acres of land. The Columbia Water Power Company, of which Samuel Berry, J. B. Valentine and Sidney Berry, of Spokane, Wash., are interested in the enterprise. The present plans include the construction of a large dam on the Methow River, about eight miles from its mouth, at a cost of $25,000. From the dam a flume about a mile in length will be extended down the river, where a power plant will be erected at a cost of at least $50,000. Transmission lines will be erected from the power house to Bridgeport, Brewster, Pateros, Methow and other towns in this vicinity to distribute electricity for lamps and motors for irrigation purposes.

PASCO, WASH.—The Moore tract, consisting of 1000 acres, near this city, has been purchased by J. W. Culver and W. H. Todd. The new owners propose to irrigate the tract, and have entered into a contract with the Yakima Water Power Company to furnish electricity for the project. The initial unit will be of 100 hp. As soon as the work is completed 500-hp pumps will be installed.

PORT ORCHARD, WASH.—The Board of Control has awarded contracts for the construction of the administration building and power plant at the Veterans' Home, at Port Orchard, amounting to $51,050. The contract for the building was awarded to Lance & Peters, of Seattle, for $28,800, and for the installation of heating plant and construction of power house to the Seattle Heating & Plumbing Company for $22,250.

REPUBLIC, WASH.—The new power plant of the New Republic Company is nearly completed and will soon be placed in operation. It will furnish electricity to operate the mine of the Republic company, also for the San Poil mine and the Blacktail mines. R. J. Howard and W. B. Parker are interested in the New Republic Company.

SPOKANE, WASH.—Mayor F. S. Pratt recommends to the City Council that the dam at the up-river pumping station be raised, to install electric motors at the station to increase the output of the pumps from 29,000,000 to 40,000,000 gallons a day, and to erect a down-town auxiliary pumping station at either Mission Avenue or Division Street and install an independent high-pressure fire system.

MARTINSBURG, W. VA.—The large hydro-electric power plant being erected by the Martinsburg Power Company on the Potomac River at Dam No. 4 is nearly completed and will be placed in operation within a few weeks. The equipment includes two turbine wheels of 1000 hp each and two generators with the same rating. Electricity will be transmitted from the plant to Martinsburg through Sheperdstown, a distance of 15 miles.

WHEELING, W. VA.—It is reported that the National Telephone Corporation, controlling telephone lines in New York, Pennsylvania, Ohio, West Virginia and Maryland, has acquired control of the West Virginia Western Company, of Parkersburg, W. Va., which operates 6000 telephones in West Virginia and Ohio. The consideration is said to be $600,000.

ANTIGO, WIS.—The Antigo Electric Company is planning to rebuild its plant this summer and will change the system from direct to alternating-current. Charles M. Cleveland is vice-president and manager.

FRIENDSHIP, WIS.—The question of installing an electric light plant in Friendship is under consideration.

KENOSHA, WIS.—Arrangements are being made by the Kenosha Electric Railway Company for the construction of a new power house, for which contracts for equipment have been placed, including one 300-kw Allis-Chalmers turbo-generator, one 200-kw Westinghouse motor generator, three 125-k.v.a. Westinghouse transformers and 180 metallic flame arc lamps.

MINERAL POINT, WIS.—The Mineral Point Electric Light Company is building a high-tension transmission line to Linden to supply electricity in that place for lamps and motors. F. C. Ludden is secretary and manager.

TWO RIVERS, WIS.—A rural telephone company has been organized to construct about 15 miles of telephone line. The company is capitalized at $6,000. Nelson LeClair is president.

WAUSAU, WIS.—Preliminary arrangements have been made by the Wisconsin River Traction & Power Company towards the construction of a dam at Trappe City. It is reported that the construction of the dam means an interurban railway between this city and Merrill, work on which will begin next spring. The right of way from Wausau to Brokaw was given to the Traction company by the St. Paul Company, it is said, in consideration of an agreement to relieve the steam railroad company of a long contract with the Wausau Paper Company requiring it to run the "scoot" which is said to be a losing proposition.

FORT YELLOWSTONE, WYO.—The contract for the construction of the reservoir in connection with the hydro-electric plant at this post has been awarded to the D'Olier Engineering Company, of Philadelphia, Pa. G. C. Smith is constructing quartermaster.

WINNIPEG, MAN., CAN.—The contract for installing electrical fixtures in the new Grand Trunk-Pacific depot, Winnipeg, has been awarded to the Robert Mitchell Company, of Winnipeg, for approximately $30,000.

TORONTO, ONT., CAN.—Bids will soon be received by the City of Toronto for the following apparatus: Two 1500-hp induction motors direct connected to turbine pumps; four 1500-hp synchronous motors with turbine pumps; four 500-hp synchronous motors with turbine pumps; two 500-hp induction motors with turbine pumps; two 300-hp induction motors with turbine pumps; two 225-hp synchronous motors with turbine pumps, together with valves, piping, bed plates, couplings, switchboards, connecting material, etc. For further information apply to the city engineer's department, Toronto, Ont., Can.

Company Elections.

BRISTOL, N. H.—At the annual meeting of the Bristol Electric Light Company the following-named officers were elected: H. H. Pattee, president; Marshall Ballou, vice-president, and George A. Emerson, treasurer and manager.

PITTSBURGH, PA.—At the annual meeting of the Philadelphia Company held recently the following-named directors were elected: J. H. Reed, president; H. J. Bowdoin, Patrick Calhoun, James D. Callery, George E. McCague, B. S. Guinness, Edwin Smith, R. H. Boggs, Sidney H. March and George E. Tener. Mr. Tener was elected to fill the vacancy caused by the death of Joshua Rhodes. All of the present officers were re-elected except Matthew Bigger, purchasing agent, who is succeeded by J. H. Reed, Jr.

PITTSBURGH, PA.—At the annual meeting of the Pittsburgh Railway Company the following directors were elected: James D. Callery, J. H. Reed, George E. McCague, H. J. Bowdoin, George W. Bacon, Patrick Calhoun, Edwin W. Smith, R. H. Boggs and George E. Tener.

TORONTO, ONT., CAN.—At a special meeting of the Lake Superior Corporation held recently, J. Frater Taylor, of New York, N. Y.; H. Coppell, of Plainfield, N. J., and J. S. Dale, of New York, N. Y., were elected directors of the corporation, to take the places of Charles S. Hinchman, of Philadelphia, Pa.; L. H. Hirt, of New York, N. Y., and R. Wilson Smith, of Montreal, Can. The other directors are: C. D. Warren, of Toronto, Can.; J. T. Lea, of Philadelphia, Pa.; T. J. Drummond, of Montreal; J. T. Terry, Jr., of New York, N. Y.; W. Gow, of Toronto, Can.; F. McOwen, of Philadelphia, Pa.; R. L. Austin, of Philadelphia, Pa., and W. K. Whigham, of New York, N. Y.

New Industrial Companies.

THE AHLM-ZORN ENGINEERING COMPANY, of Cleveland, Ohio, has been chartered with a capital stock of $10,000 by C. E. F. Ahlm and others.

THE AMERICAN WIRELESS BURGLAR ALARM COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $25,000, by S. E. Ostrom, of Brooklyn, N. Y.; M. A. Kammer, of New York,

N. Y., and S. F. Austin, of Highwood, N. J. The company proposes to manufacture and sell burglar alarms.

THE BLAUVELT & WEST COMPANY, of Montclair, N. J., has been chartered by W. E. Blauvelt, R. W. Cole, Brooklyn, N. Y.; E. West, of New York, N. Y., and J. Schneider, of Montclair, N. J. The company is capitalized at $250,000 and proposes to do a mechanical and electrical engineering business; toolmakers, machinists, etc.

THE COPLEN, KIDDER & HEGEL MANUFACTURING COMPANY, of St. Louis, Mo., has been chartered with a capital stock of $250,000, by Elbert M. Coplen, Daniel G. Kidder and K. Hegel. The company proposes to manufacture boilers and supplies.

THE ELECTRIC STEEL COMPANY OF NEW YORK, N. Y., has been incorporated, with a capital stock of $100,000, to manufacture and deal in iron, steel and ores, by W. J. Du Bois, of New York, N. Y.; J. H. Wallace, Mariners' Harbor, N. Y., and H. F. Kinney, of Brooklyn, N. Y.

THE McMILLAN PUMP, POWER & MANUFACTURING COMPANY, of Kansas City, Mo., has been incorporated by Milton McMillan, Daniel E. Bird, Benjamin F. Rounds and others. The company is capitalized at $25,000 and proposes to manufacture pumps.

THE NATIONAL TELEPHONE SELECTOR COMPANY, of Jersey City, N. J., has filed articles of incorporation with a capital stock of $500,000, for the purpose of manufacturing telephone signals or selectors, railway signals, etc. The incorporators are E. Kleinschmidt, J. A. Hughes and W. C. Merriam, Jr., of Jersey City, N. J.

THE REPEATING ELECTRIC SIGN COMPANY, of Syracuse, N. Y., has been chartered, with a capital stock of $2,500, by William H. Hall, Jr., Charles W. Webb, Edward D. Kilburn, all of Syracuse, N. Y.

THE RICE GAS ENGINE COMPANY, of Jersey City, N. J., has filed articles of incorporation, with a capital stock of $1,000,000, for the purpose of manufacturing engines, tools, machinery, etc. The incorporators are: A. J. Denahan, R. R. Hanna and J. D. Baker, of Jersey City, N. J.

THE I. J. ROYCE & COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $25,000 by Kendal & Luby, 84 La Salle Street, Chicago, Ill. The company proposes to manufacture machinery and supplies.

THE SECURITY ELECTRIC & CONSTRUCTION COMPANY, of Augusta, Maine, has been chartered, with a capital stock of $1,000,000, to manufacture mechanical and electrical machinery. E. M. Leavitt, of Winthrop, Maine, is president and treasurer.

THE STANLEY S. DE NOVENS COMPANY, of Brooklyn, N. Y., has been incorporated with a capital stock of $5,000 by Stanley S. de Novens, Frank A. Belling and Joseph Belling, all of Brooklyn, N. Y. The company proposes to do a general engineering and building business.

THE A. B. C. TRAIN OPERATING COMPANY, of Chicago, Ill., has been chartered with a capital stock of $100,000 for the purpose of manufacturing machinery and appliances by Heidman & Street, of Chicago, Ill.

THE TURBINE MOTOR ELECTRIC CAR COMPANY, of Cleveland, Ohio, has been incorporated with a capital stock of $50,000 by John T. Lister and others.

THE WATERHOUSE CARBURETOR COMPANY, of Boston, Mass., has filed articles of incorporation with a capital stock of $100,000 and the following-named officers: Harold D. Waterhouse, president; Frank G. Conway, vice-president, both of Boston, Mass., and Frederick C. Hersee, of Rolindale, treasurer.

New Incorporations.

PHOENIX, ARIZ.—The Suburban Railway Company has filed articles of incorporation with a capital stock of $500,000 to construct an electric railway in Phoenix. The directors are: A. B. King, B. A. Fowler, J. W. Dorris, George M. Halm and E. J. Bennett.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company has filed articles of incorporation, with a capital stock of $30,000,000. It is said that the company has been organized to control all the gas and lighting plants in southern California. W. B. Cline, president of the Los Angeles Gas & Electric Company, is president of the new company.

WILMINGTON, DEL.—The Ohio Central Electric Railway Company has been incorporated, with a capital stock of $500,000, by Martin E. Smith, of Wilmington, Del.; Carl C. Conkle, Pittsburgh, Pa.; Harry L. Thompson, of Uhrichsville, Ohio, and Wylie H. Taylor, of Wellsburgh, Ohio.

JENKINSBURG, GA.—The Jenkinsburg Telephone Company has been chartered with a capital stock of $200,000 by B. F. Aiken, J. F. Tingle and others.

AURORA, ILL.—Articles of incorporation have been filed for the Chicago, Aurora & DeKalb Railroad Company by J. H. Bliss, of Sugar Grove; F. W. Ravlin, of Kaneville; E. L. Lyon, F. M. Killian and J. C. Murphy, of Aurora, Ill. The company is capitalized at $50,000 and proposes to build an electric railway from Aurora to De Kalb.

DE KALB, ILL.—The De Kalb & Western Railway Company has been chartered by Newton Taylor, of Elgin, Ill.; J. F. Pearce, L. D. Grier, Frederick Krengel and Asman F. Cole, all of Chicago, Ill. The company is capitalized at $25,000 and proposes to construct an electric railway from Chicago to Rock Island.

MILL HALL, PA.—The Mill Hall & Kittany Telephone Company has been incorporated with a capital stock of $5,000. W. H. Pifer, of Lock Haven, is treasurer.

NEW CUMBERLAND, PA.—The West Shore Telephone Company has been chartered with a capital stock of $50,000 to operate in the territory from New Cumberland to Marysville and Mechanicsburg. The incorporators are: Dr. J. C. Stem, of Lemoyne, Pa.; Solomon Rupp, of Shiremanstown, Pa.; Jacob Reiff, of New Cumberland, Pa., and others.

HALLS, TENN.—Articles of incorporation have been filed for the Halls Light, Water & Ice Company, by R. A. Greer, L. S. Prescott, E. R. Parham, T. B. Caldwell and C. D. M. Greer.

LA WARD, TEXAS.—Articles of incorporation have been filed for the Bay Telephone Company by L. N. Mitchell and A. C. Joines.

NIXON (P. O.), TEX.—The Nixon Telephone Company has been incorporated, with a capital stock of $6,200, by C. S. Penfield, P. H. Tom and D. N. Campbell.

ROCKWALL, TEX.—The Rockwall Light, Ice & Gin Company has been chartered with a capital stock of $20,000 by H. A. Briscoe, M. A. Parish, M. S. Bailey and T. W. Bailey.

SAN ANTONIO, TEX.—The Metropolitan Steam & Electric Railway Company has been chartered under the laws of Delaware for the purpose of constructing electric railways in Texas. The company is capitalized at $100,000, and the incorporators are: John G. Marmion, of San Antonio, Tex.; M. Kaufman, Yorktown, Tex., and E. L. Squire, of Wilmington, Del.

TEMPLE, TEX.—The Temple Electric Light Company has been chartered with a capital stock of $5,000 by W. S. Brown, W. F. Evans, D. S. Brady and others.

TULIA, TEX.—The Tulia Light & Ice Company has been incorporated with a capital stock of $10,000 by J. W. Schwarz, J. E. McCune and E. D. Smith.

WACO, TEX.—Articles of incorporation have been filed for the Rotan Water & Light Company, with a capital stock of $10,000, by C. Hamilton, E. Rotan and C. H. Sherman.

SALT LAKE CITY, UTAH.—The Borkman Electric Company has filed articles of incorporation, with a capital stock of $25,000. The incorporators are: G. Borkman, president; P. C. Dykes and J. H. Parkes.

SUFFOLK, VA.—The Suffolk Light Company has filed articles of incorporation with a capital stock of $250,000. The officers of the company are: W. L. Williams, president; R. B. Tunstall, vice-president; A. R. Williams, secretary and treasurer, all of Norfolk, Va.

SOUTH BEND, WASH.—The Willapa Harbor Telephone Company has been organized with a capital stock of $30,000. The company has purchased the local South Bend and Raymond systems, and also the line to Bay Center. The officers of the company are: C. S. Gilchrist, of Centralia, Wash., president; F. A. Hazeltine, of South Bend, Wash, vice-president; John T. Welsh, of South Bend, secretary; H. W. McPhail, of Raymond, Wash., treasurer, and W. W. Canon, of Centralia, Wash., general manager.

TACOMA, WASH.—The Connell Northern Railway Company has been incorporated with a capital stock of $50,000 to construct an electric railway from Connell to Ritzville and Tokio.

WHEELING, W. VA.—The National Telephone Corporation, capitalized at $15,000,000, has been incorporated by John A. Howard, of Wheeling, W. Va.; Alfred S. Hayes, of Boston, Mass.; S. Stanwood Manken, of New York, N. Y.; Samuel W. Harper, of Wheeling, W. Va., and William M. Clark, of New York, N. Y. It is said that the company proposes to construct two trunk lines across the continent and absorb many of the independent telephone lines. John A. Howard is president of the company.

STURGEON BAY, WIS.—Articles of incorporation have been filed for the Peninsula Telephone Company by G. W. Greaves, John G. Walker, August Moeller. The company is capitalized at $5,000.

VANCOUVER, B. C., CAN.—The Western Canadian Power Company has been formed, with a capital of $5,000,000, to take over the plant and assets of the Stav Lake Power Company. William McNeil is secretary.

FINGAL, ONT., CAN.—The Fingal Rural Telephone Company has been incorporated to erect rural telephone lines. J. Steele is interested in the enterprise.

TORONTO, ONT., CAN.—The Erindale Power Company, with mair office in Toronto, has been incorporated, with a capital of $250,000.

DAWSON CITY, Y. T., CAN.—The Northern Light, Power & Coal Company has been incorporated, with a capital of $3,000,000.

Personal.

MR. CHARLES PARRISH, formerly of the Westinghouse Electric & Manufacturing Company, has been appointed Pittsburgh representative of the Excello Arc Lamp Company.

MR. B. E. SUNNY, president of the Chicago Telephone Company, is about to sail for Europe with the members of his family, to enjoy a vacation of about six weeks' duration.

MR. S. P. GRACE, of the Central District & Printing Telegraph Company, is the author of an article entitled "The Transmission of Telephone Currents," which appears in the current issue of *The Michigan Technics*, of the University of Michigan.

MR. BENJAMIN WALL, formerly of the Metropolitan Engineering Company, New York, has connected himself with Messrs. Betts & Betts, the well-known electric sign builders. Mr. Wall will have the management of their central station department.

MR. GEORGE E. MILLER, manager of the Cleveland office of the Westinghouse Electric & Manufacturing Company, was married in St. Louis on June 24 to Miss Anna B. Miller, of the latter city. Mr. and Mrs. Miller will be at home in Cleveland after Aug. 1.

MR. F. MATTHEWS, of Sherman, Tex., has been appointed superintendent of the Water and Light Department of Roff, Okla. Mr. Matthews has been a resident of Sherman for several years and has been connected with the electric light plant for six or seven years.

MR. HENRY H. TAYLOR has severed his connection with the Gardner Electric Light & Power Company, Gardner, Mass., with which he has been connected for the past 20 years, to accept the position as superintendent of the Buzzards Bay Electric Light Company, with headquarters at Falmouth, Mass.

MR. HERBERT G. LOWELL has resigned as superintendent of the municipal electric light plant at Templeton, Mass., to accept the position as superintendent of the Gardner Electric Light & Power Company, Gardner, Mass. Mr. Edward B. Waite has been elected superintendent of the Templeton electric light department to succed Mr. Lowell.

MR. EDWARD B. ELLICOTT, chief electrical engineer for the Sanitary District of Chicago, has received an increase in salary from $6,000 to $7,500 a year. Mr. Ellicott, who was formerly city electrician of Chicago, designed the hydro-electric plant on the Drainage Canal at Lockport, Ill., as well as the entire electrical transmission and distribution system of the Sanitary District. Supervising the electrical work of the board, he has performed his duties with ability, zeal and untiring industry.

MR. SAMUEL L. NICHOLSON has been made sales manager of the Westinghouse Electric & Manufacturing Company. This is a new position in the Westinghouse organization and it is a compliment to Mr. Nicholson's business ability that he was selected to fill it. Mr. Nicholson was until recently manager of the industrial and power department of the company. His headquarters as sales manager will be in Pittsburgh. Mr. Charles Robbins has been made manager of the industrial and power department, with which he has been connected for some time, succeeding Mr. Nicholson.

MR. WILLIAM ALGERNON BRACKENRIDGE has resigned as a member of the Advisory Board of Consulting Engineers of the new barge canal in New York to take the management of the Edison Electric Company, of Los Angeles, Col. Mr. Brackenridge is well known as a hydraulic engineer, and the company of which he assumes charge derives almost all of its power from hydro-electric plants. It operates two stations on the Santa Ana River, two on Mill Creek, one on Lytle Creek and one on Kern River. The company has about 600 miles of transmission lines and operates at 33,000 and 60,000-volt primary and 10,000-volt secondary.

MR. BYRON BRIGGS BRACKETT, A. M., PH. D., has been appointed to the chair of Electrical Engineering at the South Dakota State College, Brookings, S. D. During the past six years he has held the chair of Electrical Engineering at the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y. Dr. Brackett is not only an experienced teacher, but has had considerable experience in practical electrical engineering, having had charge of the inspection and testing of all the cable manufactured by the General Electric Company for the U. S. Army during the Spanish-American war, as well as other important work.

PROF. ELIHU THOMSON, electrician; Mr. E. W. Rice, Jr., vice-president; Mr. G. E. Emmons, Schenectady works manager; Mr. W. C. Fish, Lynn works manager, and Mr. F. C. Pratt, assistant to Mr. Rice, all of the General Electric Company, formed a party of gentlemen visiting electrical plants in Chicago and vicinity on June 21 and 22. The Fisk Street and Quarry Street generating stations of the Commonwealth Edison Company were inspected on Monday forenoon, and on that day the party was entertained at luncheon at the Union League Club, with some of the officers of the Commonwealth Edison Company, by Mr. J. W. Johnson, Chicago manager of the General Electric Company. In the afternoon there was a demonstration of the new electric fire boat *Graeme Stewart*, which was of unusual interest. Following this the party repaired to the Chicago Athletic Club, where, by the thoughtful courtesy of Mr. L. A. Ferguson, vice-president of the Commonwealth Edison Company, the gentlemen enjoyed a plunge in the fine swimming pool of that club. On Monday evening the entire party was entertained at dinner at the Chicago Club by Mr. B. E. Sunny, president of the Chicago Telephone Company, and formerly vice-president of the General Electric Company. Tuesday was spent at Gary, Ind., where Mr. W. P. Gleason, general superintendent for the Indiana Steel Company, was host. The visitors were taken about the great electrically operated steel mills and also inspected the city of Gary under the guidance of Mr. Gleason and members of his staff. Luncheon was taken at the hotel in Gary, Mr. Gleason doing the honors. The visiting electrical men, who left for the East on Tuesday evening, expressed themselves as greatly pleased with their sojourn in the Chicago area.

Obituary.

MR. WILLIAM F. EMERSON, connected with the securities department of the branch of Stone & Webster in Chicago, died of pneumonia at the Presbyterian Hospital in Chicago, after a short illness, on June 23. Mr. Emerson, who was but 26 years of age, was a graduate of Harvard College in the class of 1906. At college he was interested in athletics and was manager of the 1906 crew which went to England to row against Oxford and Cambridge. Mr. Emerson was a grandson of Ralph Waldo Emerson and is survived by his parents, living at Concord, N. H.

MR. ALBERT PAULDING BRAYTON, president and founder of the Pelton Water Wheel Company, of San Francisco and New York, died at his home in Oakland, Cal., on the 25th inst., aged 82 years. Mr. Brayton went to California in the early fifties and was conspicuous in the development of the industries of the Pacific Coast, particularly in connection with the machinery industry as applied to mining and hydro-electric development. For many years he was a member of the firm of Rankin, Brayton & Co., who operated the Pacific Iron Works, one of the pioneer concerns in the metal industry in San Francisco. He retired from this concern in 1888 and established the business of the Pelton Water Wheel Company, which, under his able and vigorous administration, has since grown to be one of the most prominent concerns in the field of hydraulic power development.

MR. ORRIN S. WOOD, one of the first telegraphers and builders of telegraph lines in the United States, died at his home in Turners, N. Y., June 22, at the age of 91 years. He entered the telegraph service in Washington in 1844, and was an operator on the original wire between Baltimore and Washington, having received his instruction in telegraphy from Prof. S. F. B. Morse. He superintended the construction of the first telegraph line between New York and Philadelphia in 1845, and opened the first telegraph office in New York, at Hanover Street and Exchange Place. The next year he built a line between Albany and Buffalo, and in 1847, through his work, communication was established with Buffalo, Niagara Falls, Toronto, Montreal and Quebec. Then he became superintendent of the Montreal Telegraph Company, which post he filled until 1866, and afterward reconstructed all telegraph lines northwest of Chicago. When this was completed the system of lines was sold to Jay Gould, and it was included later in the Western Union lines. Mr. Wood was born in Sherburne, N. Y., and retired from active business 35 years ago.

Legal.

RECEIVER APPOINTED.—The Consolidated Street Railway & Power Company, of Fayetteville, N. C., has been placed in the hands of a receiver by Judge Lyon, of the State court, W. D. McNeill, president of the company, being named receiver. This step follows the institution of several suits, while the company has been unable to float certain bonds issued, hence the acceptance of the court's protection. The operation of the road is not affected.

THE KENNETT ELECTRIC LIGHT, HEAT & POWER COMPANY IN RECEIVERS' HANDS.—Augustus Brosius, of Avondale, Pa., has been appointed receiver of the Kennett Electric Light, Heat & Power Company, of Kennett Square, Pa. The company has been in financial straits for some time. A letter issued a short time ago by Ralph Rhoads, the manager of the company, charges gross criminal misrepresentation and mismanagement on the part of those financing the company. He states that there are $165,000 first-mortgage bonds, $300,000 in stock, $27,000 overdue notes, $3,000 unpaid bills and $1,000 in unpaid salaries against the company. The interest on the bonds has never been earned, but paid out of stocks sold, and that if the plant was to be sold at a forced sale it would not bring $50,000. The plant was built by local capitalists several years ago and has changed hands several times since, and is said to be now controlled by the United Public Service Corporation, with headquarters in Philadelphia.

Trade Publications.

WATT-HOUR METERS FOR SWITCHBOARD SERVICE.—Bulletin No. 4662, issued by the General Electric Company, illustrates and describes the various types of Thomson watt-hour meters and their parts built by the company for switchboard service. The instruments are designed to retain accuracy for a long period, and are essentially high-torque devices in which the ratio of torque to friction is a maximum.

WESCO APPARATUS.—The Wesco Supply Company, of St. Louis, Mo., is distributing a series of bulletins given full information and illustrations of Wesco transformers, alternating-current generators, induction motors, bipolar generators and motors, multipolar belted generators and motors, switchboard instruments, direct and alternating current switchboards and direct-current motors. A copy of either or the entire set of bulletins can be obtained on request.

CONDUITS FOR INTERIOR CONSTRUCTION.—"Loricated" conduit is a mild steel welded tube enameled inside and outside, and "Galvaduct" has its surface thoroughly galvanized, and the tube is then treated on the interior with flexible enamel. Both of these conduits are made by the Safety-Armorite Conduit Company, of Pittsburgh, Pa., which, in a well executed catalog, presents data and illustrations relative

to its product for interior construction work. A large number of half-tones are employed to illustrate some of the large and well-known buildings in which the company's product was used.

SIDE CRANK STEAM ENGINES.—A handsomely executed catalog is that of the Ball Engine Company, of Erie, Penn., designated Catalog P, and devoted to a description of the side crank type steam engines designed and built by the company. These embrace simple, tandem-compound, cross-compound and Corliss engines. The side crank avoids the undesirable feature of an overhanging wheel, which in the case of belt driving constantly tends to wear the bearings out of line and is particularly objectionable where alternating-current generators are direct driven, because of the heavy flywheels usually required for this work. The side crank construction also eliminates the necessity for three bearings in engines direct-connected to generators.

Business Notes.

STANDARD UNDERGROUND CABLE PACIFIC SLOPE OFFICE.—On June 19 the general Pacific Coast offices of the Standard Underground Cable Co. were moved to the First National Bank building, Market, Montgomery and Post Streets, San Francisco, Cal.

COLORADO POWER COMPANIES—Notice has been received that the Central Colorado Power Company, the Eastern Colorado Power Company and the Leadville Light & Power Company have removed to their permanent offices, 1210 Seventeenth Street, Denver, Col.

H. H. CUDMORE, president of the Brilliant Electric Company, Cleveland, Ohio, asks that announcement be made that he has no longer any interest, directly or indirectly, in the Ambos-Cudmore Company, of which he was one of the founders. Mr. Cudmore's present activities are concentrated entirely in the manufacture and sale of Brilliant lamps.

M. & M. CIRCUIT FITTINGS.—Owing to the manner in which orders for M. & M. "Shallowest" flush push-button switches, receptacles and plugs, screw receptacles, wall cases, pendant switches and panel boards have increased during the past six months, the Machem & Mayer Electrical Mfg. Co., Philadelphia, found it necessary to move to a factory twice the size of its former one, and hereafter will be located at Seventeenth and Vine streets, Philadelphia.

ARMY BOILER CONTRACT.—The E. Keeler Company, of Williamsport, Pa., has been awarded a contract by the U. S. Government for boilers for three separate electrical installations at Pacific Coast fortifications. There will be two 100-hp water-tube boilers for Fort Stephens, Ore., at the mouth of the Columbia River, about 110 miles west of Portland; two of 150-hp each at Fort Casey, on Puget Sound, about 40 miles north of Seattle; and two of 200-hp each at Fort Scott for the Presidio, which adjoins the city of San Francisco, Cal. The boilers will use oil as fuel.

MULTIPLE MOTOR, VARIABLE-SPEED ELECTRIC DRIVE FOR PAPER-MAKING MACHINES.—The Standard Engineering Corporation, of Wilmington, Del., paper-mill contractors and engineers, has developed a combination with a paper-making machine of separate electric motors to drive the individual parts or sections thereof, with means for maintaining a constant working speed for the entire machine as desired, yet with the facility for varying the working speed of the individual parts or sections of the machine within small limits. The driving of paper-making machines has heretofore been accomplished electrically by the application of a variable-speed motor to a line of shafting, transmitting power to the paper machine through a complication of belts, cone pulleys, friction clutches and bevel gears. It is claimed that the new system does away with all this apparatus, and consists merely of a motor and a pair of spur gears for each section of the machine located on the machine room floor. It is, therefore, unnecessary to provide any basement under the machine, as heretofore required by the cumbersome line shafting and pulleys. The first installation of this drive was made by the Standard Engineering Corporation at the mill of the Gould Paper Company, Lyons Falls, N. Y., and has been running for a number of months, and is understood to be doing excellent work. The same company has recently secured an order from the Lincoln Paper Mills Company, Merritton, Ont., for a large electric drive for its new paper machine, an important feature of which is that the drive is designed to give a range in paper speed of from 80 to 400 ft. per minute without the usual aggregation of step pulleys, cone pulleys and change speed gear. The speed control for the entire machine will be obtained by regulating the generator rheostat.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Lloyd Lyon, Mobile, Ala.

American Association of Electric Motor Manufacturers. Secretary, W. H. Tapley, 29 West 39th St., New York.

American Electro-Therapeutic Association. Secretary, Dr. Albert C. Geyser, Willis Ave., New York City.

American Electro-chemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, New York City, 1909.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

Arkansas Association of Public Utility Operators. Secretary, J. E. Cowles, Little Rock, Ark. Next meeting, Pine Bluff, Ark., 1910.

Association of Iron and Steel Electrical Engineers. Secretary, G. H. Winslow, 557 Frick Building Annex, Pittsburgh, Pa.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Room 511, Harvester Building, Chicago.

American Street & Interurban Railway Accountants' Association. Secretary, H. E. Weeks, Davenport, Ia. Next meeting, Denver, Col., Oct., 1909.

American Street & Interurban Railway Engineering Association. Secretary, John S. Corning, Boston Electric Railway Company, Boston. Next meeting, Denver, Col., Oct. 4-8, 1909.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York. Next meeting, Denver, Col., Oct. 4-8, 1909.

Association of Car Lighting Engineers. Secretary, G. B. Colegrove, Illinois Central Railroad, Electrical Department, Chicago. Next meeting, Chicago, Oct. 5, 6, 7 and 8, 1909.

Association of Edison Illuminating Companies. Secretary, D. L. Hunting, Spokane, Wash. Next meeting, Briarcliff Manor, N. Y., Aug. 31, Sept. 2, 1909.

Association of Electric Lighting Engineers of New England. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Lift Building, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

Central Electric Railway Association. Secretary, A. L. Neereamer, Indianapolis, Ind.

Colorado Electric Light, Power & Railway Association. Secretary, J. C. Lawler, Colorado Springs, Col. Next meeting, Denver, Oct. 12, 1909.

Eastern States Independent Telephone Association of Pennsylvania, New Jersey, Maryland and Delaware. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

Electric Vehicle and Central Station Association. Secretary, H. T. Sands, 139 Pleasant street, Malden, Mass.

Electric Club, Chicago. Secretary, W. S. Taussig, 204 Dearborn St., Chicago. Meets every Wednesday noon at Chicago Automobile Club.

Electric Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electrical Contractors' Association of State of Missouri. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 4, 1909.

Electric Trades Association of Philadelphia. Secretary, E. A. Symmes, 1324 Land Litle Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York. Next meeting, New York City, October, 1909.

Florida Electric Light and Power Association. Secretary, G. F. Doig, Gainesville, Fla. Next meeting, Tampa, Fla., April 21, 1910.

Illinois State Electric Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. Secretary, P. S. Millar, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

Independent Electrical Contractors' Association of Greater New York. Secretary, J. W. Fluckner, 503 Fifth Ave., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Indiana Electric Light Association. Secretary, Fred. Leslie, Muncie, Ind. Next meeting, French Lick Springs, Ind., Aug. 18 and 19, 1909.

INTERNAL COMBINATION ENGINE ASSOCIATION. Secretary, Walter I. Sittig, 61 Ward St., Chicago.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., Sept. 14, 15 and 16, 1909.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., Eng.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

IOWA ELECTRIC ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Ia.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia. Annual meeting second Wednesday in March each year.

IOWA STREET & INTERURBAN ASSOCIATION.. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Sioux City, April, 1910.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Wichita, Kan., Sept. 22 and 23, 1909.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October, each year.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting Detroit, Aug. 17, 18 and 19, 1909.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, B. W. Cowperthwait, Faribault, Minn. Next meeting St. Paul, third week in March, 1910.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, C. L. Clary, Sikeston, Mo. Next meeting, Jefferson City, Mo., April 14, 15 and 16, 1910.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Schweer, Windsor, Mo.

NATIONAL ARM, PIN & BRACKETT ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, John F. Gilchrist, 139 Adams St., Chicago. Headquarters, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Toledo, Ohio, July 21, 1909.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings second and fourth Tuesday of each month.

NEW YORK ELECTRICAL SHOW. Madison Square Garden, Oct. 11-21, 1909.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash. Next meeting, Seattle, Sept. 7, 8 and 9, 1909.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis. Next meeting, Milwaukee, January, 1910.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next meeting, Toledo, July 13-15, 1909.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL ELECTRICAL & STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio. Next meeting, Lima, Ohio, Nov. 19 and 20, 1909.

OKLAHOMA PUBLIC UTILITIES ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla. Next meeting Sapulpa, Okla., 1910.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next meeting, Pittsburgh, Pa., Aug. 17, 18 and 19, 1909.

PACIFIC COAST ELECTRIC AUTOMOBILE ASSOCIATION. Secretary, J. T. Halloran, 604 Mission St., San Francisco, Cal. Next meeting, Oakland, Cal., February, 1910.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, E. L. Smith, Towanda, Pa. Next meeting, Eagles Mere, Pa., Sept. 8, 9 and 10, 1909.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado, Springs, Col. Meetings, second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass. Monthly meeting, fourth Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D. Next meeting Jan. 11 and 12, 1910.

SOUTHWESTERN ELECTRIC & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Texas.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, care of J. G. White & Co., New York.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRIC ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next meeting, Detroit, Mich., Oct. 26, 27 and 28, 1909.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Sidney L. Williams, 42 Broadway, New York.

WISCONSIN ELECTRIC & INTERURBAN RAILWAY ASSOCIATION. Secretary, Dudley Montgomery, Madison, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 22, 1909.

[Conducted by Wm. F. Bissing, Pat. Law, 2 Rector St., N. Y. City.]

925,452. BATTERY HOLDER; S. A. Brown, Buffalo, N. Y. App. filed Jan. 6, 1908. For connecting batteries to the instruments which they operate, by means of an insulating plate attachable to a wall and having two pins to which wires are attached.

925,495. REGULATING STEP SWITCH; B. McInnerney, Council Bluffs, Ia. App. filed June 28, 1907. Magnetically operating switches actuated at intervals in which a movable member varies the intensity of the field of the magnetic circuit and a series of unequally disposed switches are within the range of the field.

925,499. DYNAMO-ELECTRIC MACHINERY; C. A. Parsons and A. H. Law, Newcastle-upon-Tyne, England. App. filed Oct. 8, 1906. Regulates dynamos by regulating the voltage as the load increases by means of field magnets, magnetic material in proximity thereto and a winding on the magnetic material with means for supplying alternating current to the winding.

925,504. POWER TRANSMISSION; F. Porsche, Wiener-Neustadt, Austria-Hungary. App. filed Feb. 13, 1909. For driving spindles by means of a shaft, an armature thereon and a spring forming a driving connection between the shaft and armature, together with a second armature carried by the driven shaft.

925,539. FUSE PLUG; A. Weber, Jr., Schenectady, N. Y. App. filed Jan. 16, 1909. A base of insulating material for fuse plugs having a ventilating groove and a ventilating aperture extending from the groove.

925,549. TROLLEY HOLDING AND RETRIEVING DEVICE; J. W. Woodward, Rochester, N. Y. App. filed June 13, 1908. Trolley holding and retrieving device which when the wheel runs off the wire is automatically brought back. The trolley pole spring is automatically disengaged when the trolley jumps and the pole descends by gravity to a point below the wire.

925,551. RHEOSTAT; W. G. Abbott, Jr., Schenectady, N. Y. App. filed July 3, 1907. A resistance stick made hollow so as to provide a passage for cooling fluid.

925,561. SUSPENSION OF HIGH-TENSION LINES; H. W. Buck, New York, and E. M. Hewlett, Schenectady, N. Y. App. filed Oct. 31, 1907. For high potentials. Combines periodically dead ended spans, dead ended at the crossarm through two chains of insulators and intervening spans suitably suspended by means of crossarms.

925,573. TELEPHONE EXCHANGE SYSTEM; W. A. Fricke, Chicago, Ill. App. filed April 11, 1908. Telephone system for houses in which

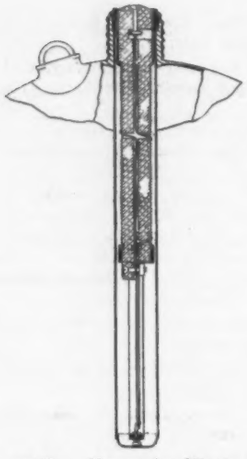
the home keys take part in the control of the application of the battery to the transmitters of telephone lines in addition to resetting the calling keys. The number of retardation coils is reduced.

925,575. AUTOMATIC FIRE ALARM; H. Furlani, Uirano, Austria-Hungary. App. filed Dec. 30, 1908. The alarm is set in operation by the fusing of an insulated mass disposed between conductive members.

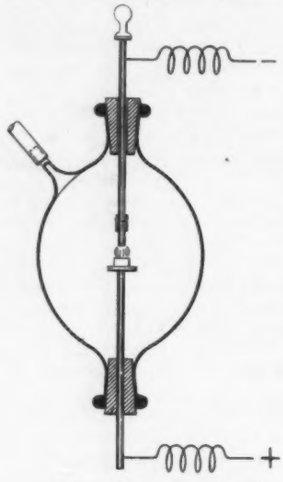
925,594. FAULT LOCATOR FOR ELECTRIC CABLES; W. O. Pennell and H. L. Hoffman, Kansas City, Mo. App. filed May 8, 1908. Varies the current which flows through the conductor by way of the fault and causes said current to induce a current in the circuit of a detecting instrument, the instrument being made neutral with respect to current flowing in the sheath of the cable.

925,599. ELECTROPLATING APPARATUS; J. B. Russ, Shelton, and C. H. Poland, Bridgeport, Conn. App. filed Aug. 19, 1908. The work to be plated is contained in a perforated tumbling drum immersed in an electrolytic solution.

925,606. MEANS FOR AND METHOD OF DETERMINING POTENTIAL GRADIENTS; W. Stanley, Great Barrington, Mass. App. filed May 13, 1905. Means and method of determining the potential gradient of a dynamo excited by alternating current.



925,681. Heater for Water Bottles.



925,798. Apparatus for Producing Homogeneous Ductile Bodies from Metals of a Highly Refractory Nature.

925,607. SYSTEM FOR GENERATING ALTERNATING CURRENTS; W. Stanley, Great Barrington, Mass. App. filed May 13, 1905. System for generating alternating current and controlling the potential gradient of the current by means of automatic reactions taking place in the system.

925,609. MICROPHONE; H. R. Stuart, Wheeling, Va. App. filed March 21, 1908. Telephone relay having two or more magnetic circuits with a microphone connected therein.

925,611. BLOCK SIGNAL SYSTEM; R. W. Taynton, Tacoma, Wash. App. filed Oct. 19, 1908. For controlling the operation of trains in connection with an interlocking semaphore system of signals. Makes use of a generator, two circuits, a switch connecting either circuit to a line, an electromagnet in each circuit, a common armature for both magnets, and an index on the armature to indicate the circuit to which the switch has connected the line wire.

925,620. VAPOR ELECTRIC APPARATUS; C. Bradway, Schenectady, N. Y. App. filed April 4, 1904. Automatic means for starting the device by creating a gap so as to produce an electrical discharge. The gap is created by an expansible element whose length changes by the heat of the current, said element being initially in circuit with the electrode.

925,622. ELECTRIC RAILWAY SIGNAL SYSTEM; C. M. Cleavland, Wausau, Wis. App. filed June 4, 1908. For warning approaching trains. The train carries an independent source of energy for sending a signal to another train and also a visual alarm. A hollow conductor rail contains the telephone or telegraph conductors.

925,666. ALTERNATING-CURRENT, DYNAMO-ELECTRIC MACHINE; W. Stanley, Great Barrington, Mass. App. filed May 13, 1905. A dynamo having an automatically compounded field for predetermining and governing the electromotive force.

925,681. HEATER FOR WATER BOTTLES; H. W. Christian, Longbeach, Cal. App. filed May 18, 1908. A water bottle with a casing extending therein and a built-up device fitting in the casing, comprising a heating coil and adjustable means for short circuiting a portion of the coil until a prearranged temperature is reached.

925,708. APPARATUS FOR VENTILATING AND COOLING STORAGE BATTERY SYSTEMS; S. Lake, Bridgeport, Conn. App. filed Oct. 31, 1908. A suitable air duct extends throughout the length of the battery compartment and is provided with a series of branch pipes extending through the covers of the cells. Particularly for submarine boats, the air duct being provided with a suction fan and having a discharge end extending through the top of the hull of the vessel.

925,732. ELECTRICAL SWITCHBOARD FOR THEATERS; C. T. Waddell, Birmingham, Ala. App. filed Feb. 21, 1906. A one or two pole board manipulated to produce the dissolving or blending of the colors and containing a minimum number of dimmers.

925,737. TELEGRAPH KEY; L. Wilson, Sidney, W. Va. App. filed March 11, 1908. A telegraph key with a secondary lever disposed over the key and arranged to automatically open and close the circuit upon gripping the key or releasing the key in the sending of the message.

925,756. TELEPHONY; G. C. Cummings, Western Springs, Ill. App. filed July 20, 1908. A telephone system with a plurality of receiving stations with receivers included in conductors which offer different degrees of deflective resistance to the voice currents, the conductor nearer the transmitting station having more effective resistance than each more distant conductor.

925,775. APPLIANCE FOR USE WITH TELEPHONE TRANSMITTERS; E. F. Hutton, New York, N. Y., and G. A. Ellis Jr., Bay Shore, N. Y. App. filed June 20, 1908. The telephone transmitter stand is placed inside the casing with sound-proof walls, the mouth of the casing being arranged to accommodate the face of the speaker.

925,776. ELECTRIC CURRENT REGULATOR; H. A. Keip, Rochester, N. Y. App. filed Oct. 1, 1908. A resistance wire with a split drum about which the wire is wrapped, made of spring material and held against expansion by the resistance wire.

925,798. APPARATUS FOR PRODUCING HOMOGENEOUS DUCTILE BODIES FROM METALS OF A HIGHLY REFRACTORY NATURE; W. Von Bolton, Charlottenburg, Germany. App. filed Sept. 29, 1905. For making ductile metals from the rare elements, by means of an exhausted air chamber containing electrodes, one of them provided with means for supporting a powder of the metal to be acted upon and the other adjustable.

925,806. APPLIANCE FOR USE WITH TELEPHONE TRANSMITTERS; O. H. Goodrich, Castleton Corners, N. Y. App. filed Sept. 14, 1908. Enclosing casing with a circuit-changing switch, and a door for the casing with an opening for the face, a telephone transmitter stand being inside the casing.

925,808. LIGHTING ATTACHMENT FOR GASEOUS FUEL BURNERS; C. E. Heft, Portland, Ore. App. filed June 5, 1908. Automatic lighting attachment for gas stoves, including a gas tube, a valve therefor, lever secured thereto, and a connecting rod pivoted to the lever and associated with the main burner valve, together with a shaft carrying a contact to produce the ignition.

925,823. SHIELD FOR CIRCUIT WIRE CONNECTIONS; T. E. Murray, New York, N. Y. App. filed Sept. 2, 1908. To prevent access to the circuit wires where they enter a block or holder, shown in patent No. 905,905, by means of a detachable tubular shield.

925,830. MULTIPLE CLUSTER LAMP RECEPTACLE; F. S. Ober, New York, N. Y. App. filed Feb. 26, 1909. For two, three or four incandescent lamps which project radially from the cluster. Made up of a blank comprising a plate with integral curved corrugated extremities constituting threaded shells.

925,884. ALTERNATING-CURRENT, DYNAMO-ELECTRIC MACHINE; B. Elshoff, Norwood, Ohio. App. filed Nov. 30, 1906. Induction motors with means for operating a short-circuiting switch. Has means for shifting an axially movable contact, comprising a toggle mechanism located within the collector rings and a push button for operating the toggle.

925,925. TELEGRAPH TRANSMITTER; C. W. Leiser, Salt Lake City, Utah. App. filed Jan. 29, 1909. Separate keys are employed, one operating the line circuit direct for making dashes and the other operating the local circuit to produce dots. Details.

925,951. MAGNET; H. Ruthardt, Stuttgart, Germany. App. filed April 3, 1908. A field magnet for magnetic inductors, such as ignitors, with a C-shaped plate forming part of the field and a circular armature gap therein, the plate gradually increasing in width toward the gap.

925,976. HIGH-SPEED DYNAMO-ELECTRIC MACHINE; A. H. Wouters, Norwood, Ohio. App. filed Nov. 3, 1906. For turbo generators. Provided with a field yoke, separable field poles and distributed auxiliary field coils on the inner ends of the poles, together with additional means for holding the coils so that the main field coils may be removed without disturbing the auxiliary coils.

925,991. VENTILATING MEANS FOR LAMINATED CORES; A. J. Brown, Norwood, Ohio. App. filed Oct. 19, 1905. Permits the free circulation of air by proving a spacer for the laminae comprising a U-shaped member with a lateral projection.

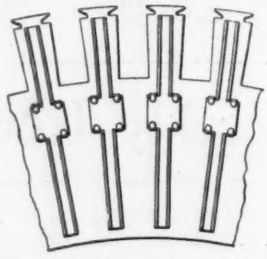
925,994. OIL SWITCH; H. W. Cheney, Norwood, Ohio. App. filed Aug. 30, 1905. A switch with a pair of contacts both movable, with contact rods on which the contacts are supported extending out of the tank through the cover.

925,995. CONTROLLER; H. W. Cheney, Norwood, Ohio. App. filed Jan. 8, 1908. A rheostat having a brush movable over contacts, carried by a pivoted arm with a spring rotatable about the same pivot as the arm, with means for preventing relative movement of the spring and arm unless the spring is first raised from the brush.

926,001. SWITCH; G. W. Hart, Hartford, Conn. App. filed Oct. 15, 1908. A push-button switch which can be operated manually at the switch, and also electromagnetically from a distance. Details.

926,020. TROLLEY ATTACHMENT; F. V. Polakoskey, Peekskill, N. Y. App. filed June 23, 1908. Keeps the trolley on the line and provides an additional means of conducting current from the line.

926,022. ELECTRIC BLOCK RAILWAY SIGNAL; E. B. Samuels, Deatsville, Ky. App. filed Oct. 22, 1907. For electric block railway signals in which the train automatically sets the signals by spreading spring arms through contact with the wheel of the train, which arms control the circuits.



925,991. Ventilating Means for Laminated Cores.

926,057. ADJUSTABLE SUPPORT FOR VAPOR LAMPS; Stanwood E. Flichtner, Englewood, N. J. App. filed Jan. 9, 1905. A bracket which permits tilting of the lamp so as to start it.

926,069. PROCESS OF TREATING METALLIC FILAMENTS FOR ELECTRIC INCANDESCENT LAMPS; W. Majert, Berlin, Germany. App. filed July 10, 1908. The process of cleaning metallic filaments by highly heating them twice in succession by an electric current, the first time in a neutral gas atmosphere and the second time when they are in a practically evacuated space.

926,086. DYNAMO-ELECTRIC MACHINE; B. A. Behrend, Norwood, Ohio. App. filed Aug. 21, 1905. An annular stationary member for dynamos having circumferential air passages closed at the inner periphery, and at its middle an enlarged circumferential air passage open at the inner periphery and communicating with the first passage.